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The Physiotherapy Review

Vol. IX No. 4

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THE AMERICAN PHYSIOTHERAPY ASSOCIATION
AUGUST-SEPTEMBER, 1929

Chapter Directory

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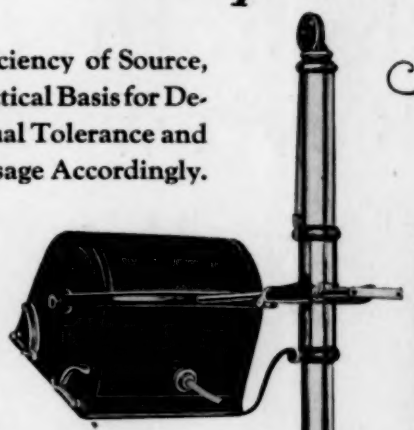
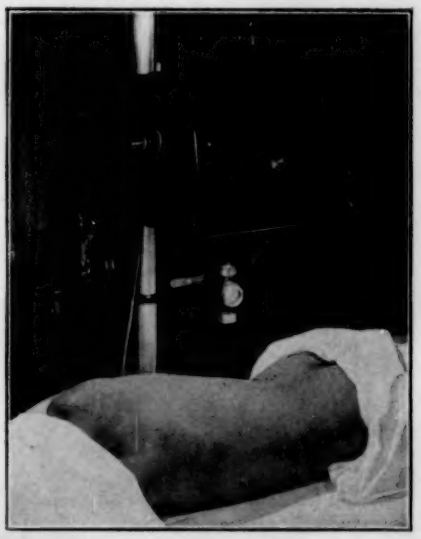
Important Developments in Apparatus for Ultraviolet Therapy.....

Increasing the Efficiency of Source, and Offering a Practical Basis for Determining Individual Tolerance and Administering Dosage Accordingly.



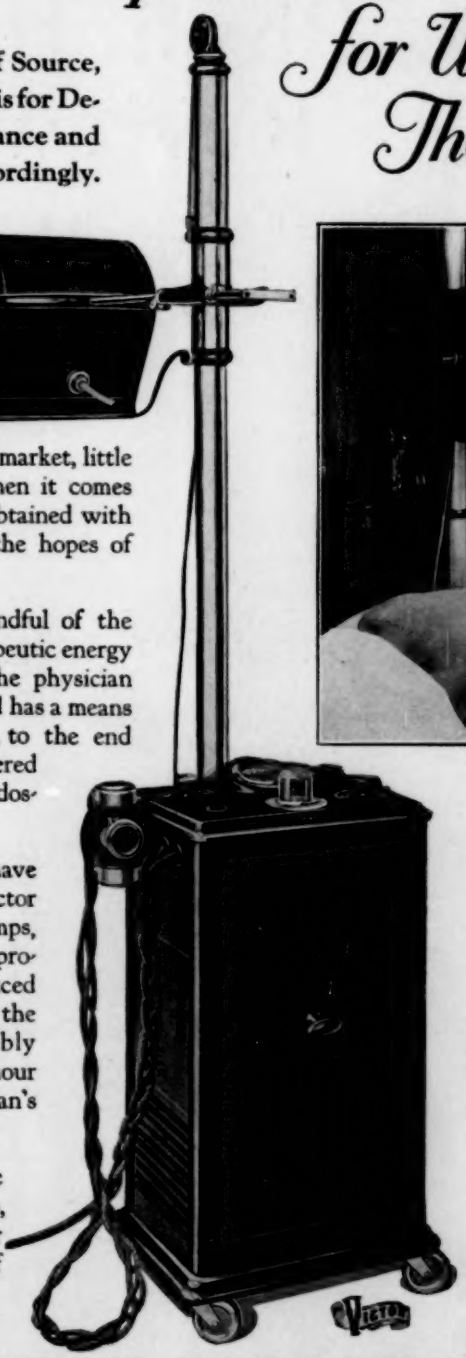


ONE of the present-day problems in the field of ultraviolet therapy is that of correct measurement of dosage. With a myriad of types of ultraviolet lamps on the market, little wonder that there is confusion when it comes to comparison of clinical results obtained with two or more types of lamps, in the hopes of standardizing ultraviolet dosage.

The Victor organization is mindful of the fact that the efficiency of any therapeutic energy can be determined only when the physician using it knows its potentialities, and has a means of absolute control of the energy, to the end that it can be intelligently administered with a definite knowledge of the dosage given the individual patient.

Several important developments have been recently incorporated in the Victor line of Mercury-Arc Quartz Lamps, offering definite advantages to the profession. Treatment time is reduced from minutes to seconds, enabling the clinic to administer a considerably greater number of treatments per hour or day, and conserving the physician's time during office hours.

Write for information on the latest models of Victor Quartz Lamps, also regarding the basis for greater accuracy in the measurement of dosage to the individual patient.



Model "A" Combination Air- and Water-cooled Quartz Lamp, one of the Victor line of mercury vapor lamps designed to permit the use of intensified, short time technic.

VICTOR X-RAY CORPORATION

Manufacturers of the Coolidge Tube and complete line of X-Ray Apparatus VICTOR ***Physical Therapy Apparatus, Electrocardiographs, and other Specialties***

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A GENERAL ELECTRIC ORGANIZATION

VOLUME IX NUMBER 4

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Membership in the American Physiotherapy Association is five dollars a year, including two dollar subscription for THE PHYSIOTHERAPY REVIEW. Single copies 35 cents. Subscription for non-members to THE PHYSIOTHERAPY REVIEW $2.50 a year. Single copies 50 cents

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ELEANOR JONES.....Walter Reed Hospital, Washington, D. C.

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DR. HOWARD MERKEL

EDITORIAL

AMERICAN PHYSIOTHERAPY ASSOCIATION
President's Report

I would much prefer to give a report of the activities of the American Physiotherapy Association's residence in San Francisco during the year 1928-1929, next year, than this. When we received a deluge of files, gavels, telegrams, etc., it was all so new, so amazing to take the reins of a full-fledged working national association, that the first reaction was to throw up our hands in bewilderment. As Miss Ewing said recently when we forgot to get the local addresses of our guests: "If they would only give us this job twice, we might learn how."

Looking back at our year of learning the machinery of the association, the innumerable meetings to decide on committees, membership qualifications, legislation, strengthening our ties with the medical profession, endeavoring to boost our educational standards, reaching our members through the chapter activities and the REVIEW, directing the general trend of our interests to stimulate scientific investigation (which is, after all, our most convincing argument for existing in the eyes of the medical world), planning this most interesting and stimulating convention—this has been a full year.

Each committee will give a report of its work. I will not take your time to duplicate the story of their accomplishments. I would like to outline a few of the outstanding details.

This seems to be an educational year. We have added to our approved list of schools the Tacoma General Hospital School. The executive committee has approved a course at the University of Michigan and at the Boston School of Education. The Council of Physical Therapy of the American Medical Association has not as yet acted on these courses. The courses submitted by Miss Merril, courses 441 and 444 at Harvard University, are to be submitted at this convention. Vancouver General Hospital submitted a course and was asked to bring its course up to standard before approval. We are assured by Vancouver Hospital that they will bring the course up to our standard as they desire to be on our approved list.

We have sixty-seven new active members and twelve new junior members, totalling 75 new members for the year 1928-1929. We have also included three new chapters, Wisconsin, Southern California and Northern California.

The report of the legislative committee and the appointment bureau will tell of their work which I will not go into here.

Miss Beck is here to tell you of the activities of our REVIEW. I am very much impressed by the journal's new dress and also by the fact that scientific articles are the rule now and not the exception. The vocational bureau of California and Minnesota and the circular letter from California to the Physiotherapy Association of that state concerning the aims, interests and requirements of our association are attempts to put ourselves before the medical world. A real accomplishment in this direction has been that the council acts jointly with the executive committee in the approval of all new schools of physiotherapy technicians.

As president, may I say the executive committee wishes to thank the members for their great trust in putting such confidence in them to carry on this interesting and stimulating work and we wish to assure you of our gratitude for your hearty support.

Respectfully submitted,

HAZEL E. FURSCOTT.

Secretary's Report - 1929

The executive committee held nine meetings during the year. Because of the change of location of offices and the resultant delay in receiving files, the first meeting was not held until September, 1928, and the last July, 1929.

I. Committee Appointments:

(1) Education and publicity committee, chairman, Miss Marguerite Irvine. A member of each chapter to serve on this committee.

(2) Legislative committee, chairman, Miss Eleanor Jones. A member from each chapter to serve on this committee.

(3) Circulation manager, Miss Gertrude Beard to take Miss Mezek's place after resignation.

II. New Chapters Admitted:

(1) Northern California.
(2) Southern California.
(3) Wisconsin.

The executive committee is very glad to welcome such live chapters into the national organization.

III. Approval of New Physiotherapy Schools:

(1) Tacoma General Hospital, Tacoma, Wash., under the direction of Miss Ruth C. Bobb.

(2) University of Michigan Hospital, Ann Arbor, and the Boston Normal School of Physical Education, physiotherapy course. This course has been approved by the executive committee and the committee on education and publicity and now awaits the O. K. of the

Council on Physiotherapy of the American Medical Association.

(3) There are several other schools under investigation for approval.

IV. Financially the executive committee voted two disbursements, one of $50.00 to Miss Irvine to come to San Francisco to meet with the executive committee for business purposes, and the other $80.00 to help defray Miss Dorothea Beck's expenses to the convention. The committee not only wished to show appreciation for Miss Beck's outstanding work on the REVIEW, but also decided that her presence was necessary for the running of convention business.

V. Educationally the executive committee has made an attempt to interest the University of California in establishing a school of physiotherapy. To date nothing definite has been accomplished except to gain the good will and enthusiastic approval of the dean of the medical school. We hope to report satisfactory progress on this question before the next convention. The U. of C. Hospital has voted certain sums of money to efficiently equip the hospital and clinic with P. T. apparatus.

VI. Of general interest to members and chapter, two rulings have gone into effect:

First, that any chapter member may be transferred to any other chapter without repayment of yearly chapter dues, by presenting a written request from the secretary of the chapter.

Second, delinquent members may be reinstated by payment of all back dues providing they are in arrears for not more than two years. Those in arrears for a longer period must present new applications. This may work a hardship on some who joined the association in the early days of the organization as by the present standards, they may not be eligible at this time.

VII. The later meetings of the executive committee were taken up with convention business which entailed an enormous amount of work with little evidence to show for it.

Respectfully submitted,
CHARLOTTE BALLARD,
Secretary.

Treasurer's Report - May 1, 1929

The financial report shows in a definite way how our organization has been growing and what it has been doing.

This year to May 1, we have had 67 new active members and 12 juniors. Since then we have added at least 30. We have lost 34 by resignation or dropped because of non-payment of dues. These figures differ very little from last year. The total paid-up membership is 468 against 413 last year. Three new chapters have been added, Northern California, Southern California, and Wisconsin.

Our expenses have increased through the cost of publication of the REVIEW which has doubled, but the extra issues and the increasing high standard of the magazine are sure to bring us more members which should make up for the difference next year. Last year REVIEW subscriptions and sales came to $32 and this year to $153 which is a decided increase.

I should like to thank the chapter treasurers and members at large for their splendid cooperation in collecting and paying dues. It has been quite impossible to answer all of the friendly notes that have been received this year, but they have been much appreciated and make me look forward with pleasure to the coming year.

Respectfully submitted,
FLORENCE BURRELL,
Treasurer.

AMERICAN PHYSIOTHERAPY ASSOCIATION AUDIT FOR YEAR ENDED APR. 30, 1929

May 3, 1929.

Miss Hazel Furscott, President,
American Physiotherapy Association,
Fitzhugh Building,
San Francisco, Calif.

Dear Madam:

We have audited the treasurer's accounts of the American Physiotherapy Association for the fiscal year ended Apr. 30, 1929.

All receipts reported were deposited in the banks and all disbursements made by the treasurer were properly authorized. Bank balances were reconciled with the books and deposits in banks verified by confirmations received from the depositories. A summary of receipts and disbursements for the period under review is included in this report.

During the course of our audit we discussed with your treasurer certain changes in the keeping of records of the association. The installation of a new membership record and certain changes in the cash receipts and disbursements book would reduce the detail work to a considerable extent and would give more complete and detailed information than at present.

Very truly yours,
FARQUHAR AND MANNERS,
Certified Public Accountants.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR YEAR ENDED APR. 30, 1929

Receipts:		
Membership dues:		
Active members	$2,220.00	
Junior members	45.00	
Associate members	21.00	
Total		$2,286.00
Association REVIEW:		
Subscriptions	$ 61.00	
Advertising and sales	92.02	
Total		153.02
Banquet		153.00
Interest on savings account		29.02
Total receipts		$2,621.04
Disbursements:		
Printing REVIEWS	$1,272.30	
Vocational bureau expense	200.67	
Printing and stationery	218.36	
Postage, telephone and telegrams	137.76	
Officers' travelling expense	178.79	
Convention expense	64.75	
Banquet expense	189.20	
Auditing accounts	54.50	
Services	42.10	
Die for association pin	33.00	
Magazines and exchange	25.00	
Treasurer's surety bond	6.25	
Refund of dues	41.00	
Total disbursements		2,463.68
Excess of Receipts over Disbursements		$ 157.36
Balance in Banks—Apr. 30, 1928:		
Gary State Bank—commercial account	$ 621.64	
Gary State Bank—savings account	1,002.50	
Total		1,624.14
Balance in Banks Apr. 30, 1929:		
American Trust Co., Oakland—commercial account	$ 749.98	
Gary State Bank—savings account	1,031.52	
Total in banks		$1,781.50

Report of the Committee on Education and Publicity

The committee on education and publicity respectfully submits the following report. The committee was handicapped somewhat this year in its work, due to the illness of the former chairman. However, since then it has been functioning to the best of its ability although the committeemen are widely separated in point of location, one having been chosen from each local chapter.

The object of our committee is the standardization of education in physiotherapy. To this end we have tried to collect information from various sources such as hospitals, schools and clinics in regard to the type of work used and the preparation and training required of the physiotherapist employed in these various institutions.

This year our letter of inquiry which we sent out to all the new schools about which we had heard, brought us the result we had hoped for. We found that the Tacoma General Hospital, Tacoma, Wash., was offering a one year course in physiotherapy which more than met our national association requirements. The curriculum of the Tacoma General Hospital at the present time is open only to physical education graduates. The hospital is equipped with a very splendid dissection laboratory which is not only open for doctors on the staff of the hospital but is for the use of the students in the physiotherapy training course as well. Such subjects as physics and chemistry are taken at the College of Puget Sound; the practical work is taken right in the hospital as they have a very splendid department with every type of case on which to work.

The Boston School of Physical Education also applied for membership as an approved school this year, and now only awaits the approval of the Council of Physical Therapy of the American Medical Association, in order to be placed on our list. Their application was received too late to be passed on by the council before its national meeting.

The announcement has just come that the University of Michigan has recently authorized the establishment of a course in physiotherapy. We hope soon to be able to report that they have asked for and received the approval from the proper source so that they may become a recognized school and be placed on our approved list.

So far the committee has been unable to get a response from the Canadian schools except Vancouver General Hospital. This school has not been considered for our approved list as they are planning a reconstruction of their curriculum and we will await their application after that.

In summary: We have one training school in Philadelphia, Pa.; one in Washington, D. C.; one in New Haven, Conn.; one in Chicago, Ill.; one in Los Angeles, Calif.; one in Tacoma, Wash. In addition, there are two post-graduate courses in Boston, Mass., and one at Battle Creek, Mich.

The committee has in its possession the complete bibliography of literature on physical therapy, up to July, 1928, and expects within the next few weeks to complete this up to July, 1929. This bibliography is for the use of any member who wishes to refer to it.

MARGUERITE I. IRVINE,
Chairman.

Annual Report of the Legislative Committee

The legislative committee has corresponded with more than ninety people during the year. Some of the letters sent out were in the form of a questionnaire but the majority were in reply to physicians and members of examining boards desiring information on state laws, etc.

The committee has on file printed copies of bills of the states which regulate the practice of physiotherapy. It has endeavored to find out what each chapter has done in regard to state registration.

Early in the year the following communication was sent to each chapter: "Will you find out (a) if your state has a law governing physiotherapy; (b) if your state has a physiotherapy department in connection with state protection or workman's compensation law?"

The following replies are on hand.

1. Minnesota has no law governing practice of physiotherapy although the association has succeeded in getting through an amendment to a bill regarding masseurs which excluded physiotherapists who worked under the direction of a physician or in a hospital. The chapter is working for legislative protection. It has a law protecting industrially injured but no physiotherapy in connection with it.

2. Illinois has a compensation law—each industry employing a physician who prescribes physiotherapy.

3. California has a law governing the practice of physiotherapy.

4. New York has a law governing physiotherapy. Chapter recently incorporated.

5. Massachusetts has had a workman's compensation law since 1912. Physiotherapy is prescribed but is not state-controlled.

6. Pennsylvania has a law governing the practice of physiotherapy, also a workman's compensation act with prescribed physiotherapy. This chapter has been active in preventing the passage of a chiropractic law which would have been harmful to the physiotherapist.

7. New Jersey has no law governing physiotherapy. Has no physiotherapy for its industrially injured.

8. Washington, D. C. The physiotherapist must secure a license under the drugless law act. Physiotherapy is provided for the industrially injured. Chapter committee working on more adequate legislative protection.

9. Alabama, Kentucky and Virginia, while having no definite state regulation, do, however, require an examination from the medical examining board or from the state board examiners.

The work of our association looms large and clear. Physiotherapy has made tremendous strides in practically all our large hospitals and the temptation is to rest content with that gain. But the legislative committee has been impressed in its travels through the East with the numerous self-named "physiotherapists," illiterate and untrained, working in small cities. Let each chapter bend its energies toward the enactment of proper legislation for the protection of physiotherapy.

ELEANOR MOORE JONES,
Chairman for the Committee.

Annual Report of the Bureau of Appointments

June 1, 1929.
Washington, D. C.

Madam President and Friends:

I am sorry my vacation is taking me to another part of the country, so that I cannot see my old friends and meet the newcomers at this convention.

The bureau has had a very busy year. Calls have come from 21 states, offering 47 positions, as against last year's record of 16 states with 32 positions. For these 47 positions 237 members have been recommended.

Nearly 100 applications for membership blanks have been sent from the bureau, during the year, not to mention the numerous requests for the "approved school" list. Plenty of extra space has been left on this blank for additions and I hope before another year passes we will have most of this space filled.

When I was cleaning house in my active file this spring, I was surprised to learn from the replies received in answer to my letters, that many members had never heard about positions for which they had been recommended. What is the best and most efficient way of reaching doctor and applicant? Suggestions will be most gratefully appreciated.

A report of finances is herewith enclosed, showing a balance to date of $6.76.

With best wishes for a most successful and enthusiastic convention,

Respectfully submitted,
C. GRACE COURTER.

Balance, June, 1928		$28.10
Receipts:		
Check from Miss Burrell, treasurer, Jan., 1929		25.00
Balance, Dec., 1928		$53.10
Disbursements:		
June, 1928, to Dec., 1928	$23.32	
Jan., 1929, to June, 1929	23.02	
		46.34
Balance, June, 1929		$ 6.76

Society of Apothecaries of London, Roll of Bio-Physical Assistants

Reprinted from The Journal of the Chartered Society of Massage and Medical Gymnastics, July, 1929

The medical profession in Great Britain is unanimous that it is desirable to enroll, on a register kept and published by some responsible body, an authoritative list of those who are fit and proper persons to undertake the treatment of patients by light and electricity.

The British Medical Association, representing over 30,000 doctors, has invited the Society of Apothecaries to inaugurate and keep up to date a roll of registered persons to whom members of the association and others can confidently issue prescriptions for treatment by electricity or irradiation, and also to ensure that unqualified assistants in electro-therapeutics should have adequate training and registration in this branch of medicine.

Acting upon this invitation, the Society of Apothecaries appointed a committee consisting of:

The Master and W. E. Dixon, representing the Apothecaries' Society.
L. D. Bailey, representing the C.S.M.M.G.
C. B. Heald, representing the B.M.A.
Major-Gen. Collins, representing the B.R.C.S.
H. B. Muir, representing the B.I.R.
Sir William Hale-White, K.B.E., M.D., F.R.C.P.
F. D. Howitt, Hon. secretary to the committee.

CONDITIONS OF PROVISIONAL ADMISSION TO THE ROLL

An approved course of training will be necessary for all who desire to be placed on the roll, and all applicants after May 31, 1930, will be required to pass an examination. But in order that injury should not be done to those persons who are already qualified and are engaged in treatment by electricity and irradiation, it is proposed that admission to the register may be obtained under the following conditions:

That the applicant:

1. Makes application not later than May 31, 1930;
2. Produces satisfactory evidence of experience in the following subjects: Ultra-violet radiation, light and heat, high frequency current, including diathermy, Faradism, direct and sinusoidal current. This evidence should consist of either:

(*a*) Not less than two years supervised practical experience at a teaching hospital or at any approved institution with a special physiotherapy department under a specially appointed medical officer, or

(*b*) A certificate signed by two medical practitioners who are on the senior medical staff of a voluntary hospital stating that from their personal knowledge they know that the applicant has had not less than three years practical experience in the therapeutic administration of each of the above-mentioned forms of treatment.

If an applicant who applies before May 31, 1930, has not had experience in one or more of the subjects, the society is prepared to consider certificates from a medical officer in charge of an approved institution, stating the course of training applicant has undergone. The society may, during the period ending May 31, 1930, require any applicant to submit himself or herself to a *viva voce* and practical examination in any of the subjects.

Before being placed on the roll applicants will be required to subscribe to the following rules:

That they will not:

(*a*) Undertake the treatment of any patient except under the direction and control of a registered medical practitioner.

(*b*) Advertise in a professional sense except in the recognized medical and nursing papers.

(*c*) Sell goods to patients in a professional capacity or accept secret commissions on the sale of goods.

(*d*) Act in such a manner as, in the opinion of the society, is considered derogatory to the honor of their profession.

Each person on registration shall pay to the society the sum of two guineas*, and all persons on the register shall pay to the society annually on Jan. 1 the sum of five shillings. Where the annual fee is not paid the society shall have the power to erase the name of the person from the register.

Registered persons will be designated bio-physical

*With reference to registration it is understood that certain concessions with regard to fees in consideration of fees already paid will be granted to those who already hold a certificate in massage and medical gymnastics. Members of the C. S. M. M. G., therefore, are advised to submit their applications for registration through the secretary of the C. S. M. M. G.

assistants and be entitled to use the registered letters B.P.A. They will receive from the society a certificate of registration and a book containing the regulations.

The society undertakes to advise medical men by every means in its power to employ only registered bio-physical assistants in the treatment of their cases.

The register will be circulated widely each year to registered medical practitioners, to medical and public libraries, and to public medical officers, so that it may be available for reference in every district of the country.

An annual conference of bio-physical assistants will be arranged at the hall for professional and social purposes.

Applications for registration should be made to the Registrar, Society of Apothecaries. Walter Lane, Blackfriars, E.C. 4. Members of the C.S.M.M.G. should apply through their own society.

Basic Science Statutes

Harry Eugene Kelly of the Chicago Bar, Chicago

Read before the Annual Congress on Medical Education, Licensure and Hospitals, Chicago, February, 1929
Reprinted by permission from the Federation Bulletin, July, 1929, published monthly by the Federation of State Medical Boards of the United States

If every member of the A. P. A. had been in Portland what a tremendous wave of enthusiasm and work would sweep through our chosen field. A fitting reward for the uncounted amount of effort and time spent by the various committees. Your attention is called particularly to the reports of those on Legislation and Publicity and Education. The general feeling of the meetings emphasized again and again longer preparation, greater attention to basic sciences and personality plus. There ever rises the question "As we are protecting our profession to give good service to the doctors and surgeons how are the states protecting our status?"

It is interesting to read in connection with these committees' reports the reprint from the Journal of the Chartered Society of Massage and Medical Gymnastics and the following article by Mr. Harry Eugene Kelly:

Legal Status of the Cult

The cults, notwithstanding the weakness of their theories, have been making steady progress with legislative assemblies throughout the country, and undeniably have obtained from them favorable recognition by law. In some states they have won all that they have sought, including their own administrative boards, entirely independent of the higher general professional standards maintained by the state and of the administrative agencies for enforcing them. In other states they have won substantial recognition without separate boards. But it is undeniable that throughout the country as a whole they have made noteworthy progress during the past thirty years in establishing for themselves a very considerable legal status, and that they have seriously retarded and impaired the establishment and maintenance of the single standard of professional qualification for all physicians alike.

Those of us who have been engaged from time to time in presenting arguments to legislative assemblies respecting the basis for the regulation by law of the occupation of healing the sick, and therein have been supporting the establishment, or maintenance, of the single standard of qualification for all physicians alike, regardless of the disagreements among devotees of the so-called "schools" and "systems of healing," have been forced to the conclusion that the cults, by various means, most of them disreputable, have induced a large part of the public and many of the legislatures to give them friendly and substantial recognition to the very perceptible detriment of the public health.

It does not matter that such recognition is illogical, detrimental to the public health, obstructive of the maintenance of proper professional training and standards of scholarship, and founded very generally, in the last analysis, on the inclination of legislators to yield to persistency rather than reason.

Corrective Legislation

The fact that the claims of the cults are in truth without merit, but nevertheless are recognized by law, moves us to seek a method, indirect though it must be, of protecting the public health against the low standards of professional training advocated and established by them. From time to time during the existence of the cults, various suggestions have been made to this end. One of the oldest is that of providing by law that knowledge of only a few fundamental sciences shall be required legally to authorize a physician to heal the sick, without regard to the *method* of his treatment of diseases, and that knowledge of therapeutic agencies of every kind shall be disregarded in conducting official examinations.

"Basic Science" Statutes Not Entirely New

This plan has recently been developed into the existing so-called "basic science" statutes. There are some new features about these statutes; but the basic idea of eliminating from the official examinations the controversial subjects is not new. In 1881 Colorado passed an act for licensing physicians, in which it recognized certain sciences as basic in the education of physicians, and specifically eliminated materia medica and therapeutics from the required examinations. This Colorado act excluded these controversial subjects in order to avoid the evils of special legislation for various cults. The act did not recognize any cult, as the basic science statutes do either impliedly or specifically. It was continued in force for twenty-five years, when, in 1905, its successor reënacted essentially the same plan, but not without mentioning osteopathy, and continued for another decade, when the cults achieved more particular recognition in subsequent legislation.

Under the old Colorado statute examinations were conducted in every necessary science except materia medica and therapeutics, the two subjects over which the controversies have arisen. This was a logical solution of the difficulty. If it had also provided for the appointment of examiners not in any way connected with the practice of the healing arts, it would have been a truly basic science law and might have survived. But it was finally discarded because the examiners in control were appointed from the regular physicians, who were charged with not being willing to give the representatives of the cults an impartial examination in the various subjects. The charge, of course, was untrue. Nevertheless its constant reiteration brought about the destruction of the single standard erected by the statute, and substantiated specific recognition of the cults.

Theory of the Basic Science Statute

Serious attention may well be given to the adroit method that has been embodied in the modern basic science statute. It proceeds on the assumption that cults

exist, and have substantial legal recognition in separate boards, within the jurisdiction, and that all of the statutes establishing methods for licensing physicians of every kind should be amended by another statute requiring of physicians of all cults accurate knowledge of certain sciences deemed basic in the opinion of members of all of the cults. Whether resort to such a basic statute will prove to be merely an overwhelming victory for the cults, and a destructive defeat for the advocates of the highest professional training, or whether resort to such a statute will prove to be instrumental in creating higher standards of professional training for all of the cults, depends chiefly on the nature of the statute, as to the number and character of the scientific subjects declared therein to be basic, the examiners to be placed in charge, the effect of the certificates of proficiency granted in such sciences, and whether these examinations and the certificates of proficiency are to be based on a high standard of scholarship without modification to suit any so-called "school" or "system of healing."

The theory of the basic science statute, as I conceive it, may be briefly stated.

1. The examiners must be persons scholastically qualified in a high degree to conduct the examinations, and must *not* be engaged in the practice of the healing arts. This provision, if systematically administered, would in theory give the highest efficiency in determining the knowledge of the applicant in the various subjects in which the examination is conducted, because the examiners would not only be intellectually qualified, but would presumably be able to conduct examinations without being influenced by the alleged prejudice against the claims made for some methods of healing. Under such a system of examination the devotees of the various cults would be deprived of their stock argument that the examiners are prejudiced against them, and, therefore, do not treat them fairly, with the expected result that they would apply for, and enter, the examinations with a feeling of security that they would be tested alone on their actual merits.

2. The emphasis would be put on demonstration of qualifications by examination and not on study in a college, so that the devotee of the cult would be given security that his actual learning and intellectual power, and not his educational pedigree, would determine his rating as an applicant for a license to practice the healing arts, and he would be freed from the alleged thraldom of mere arbitrary curriculums in the control of persons unfriendly to him or his cult.

3. The applicant for the examination, if he passes it, receives a certificate which entitles him to credit for possessing enough knowledge to prevent him from being dangerous to the public health, and entitles him to a license to practice the healing arts, if he shall submit himself to and pass the special examination by such particular examiners as have the right under the law to issue licenses to practice generally or in one of the cults. This provision does not, and is not supposed to, put all applicants for licenses of every kind on a parity as to attainments, regardless of "schools" or "systems of healing," or even to bring about as to these basic sciences a single standard of intellectual qualification. The nonsectarian examiners, and the cult examiners, may impose other examinations, or additional conditions, according to the other statutes under which they act, before admitting the applicant to practice. The basic science statute merely establishes a minimum standard of scientific scholarship to which all applicants for licenses must submit.

4. By this method each cult, while submitting to the strictures of this minimum standard, preserves its right to exist, and to issue its propaganda about its alleged usefulness, and to continue its schools, so that those who are interested, from whatever motive, in keeping the cults going are not antagonized by the basic science statute in their efforts in that respect. Without a certificate of proficiency in the basic sciences a person *is not permitted* to secure a license of any kind, and with such a certificate he *may not* secure a license of any kind, so far as the basic science statute is concerned, for he still must pass the nonsectarian or cult examiners on the basis of their own requirements.

EXAMINATION OVEREMPHASIZED

In analyzing the provisions of the basic science statutes that have already been adopted, I am impressed by the controlling emphasis which these statutes place on the *examination,* as the superior and final test of the accuracy and sufficiency of the knowledge possessed by the applicant for a license to practice the healing arts. All of these statutes apparently exclude any emphasis on the training that an applicant has had in any college. In my view there is no method of training that ought to be acceptable except that which is from time to time supplied in good medical schools. It is deemed possible for an applicant, sometimes by accident, sometimes by a system of cramming, to pass an examination, and apparently show a sufficiency of knowledge, without having had the training in the subject that under modern conditions is deemed requisite to protect the public health, and that should reasonably be demanded under modern conditions by the state. It is a mistake to put the emphasis on proof of qualification by examination. The emphasis ought to be put on proof of actual training, instruction and accomplishment in the laboratory, lecture room and clinic. The framers of the basic science statutes, in placing the emphasis on examinations, have simply yielded to the insistence of the cults on their right to conduct low grade schools of instruction and to compel the recognition of them as sufficient for qualifying physicians for the practice of healing. They have found it impossible to recognize such schools, and have therefore adopted the examination as proof of qualification. The surrender to the cults in the abandonment of proof of many years intensive training, instruction and accomplishment in high grade schools of instruction, and the substitution therefor of an examination of a few hours duration, is retrogression that ought not to be embodied in the law.

OBJECT TO COUNTERACT MULTIPLE BOARDS

It is apparent, from an examination of the theory of the basic science plan, that its object is to supply an antidote for multiple boards of examiners. It *pretends* that there are fundamental sciences which are used by all of the cults, that all of the cults seek proficiency in those sciences, that the public good requires at least a certain minimum of proficiency therein, and that all of the cults are willing to submit themselves to disinterested scholarly examiners known to have no prejudice and no ulterior object in view. These pretensions are not well founded in fact. There are many cults that do not make such admissions. Persons who originate cults, or keep them alive, are not actuated by any such motives.

But it may nevertheless be advisable to enact a basic science statute in a state maintaining multiple boards, in order to force the application of reasonable standards of scholarship on cult practitioners—and, of course, that is really the object—for the protection of the public health; but I feel impelled to warn you that we should not expect it to eradicate the worst of the evils of cults. Most of the difficulties that confront us in regulating the practice of the healing arts, on a basis of reasonable educational qualifications, inhere in the ignorance, selfishness and cupidity of certain classes of persons who have no

respect for law as a rule of justice, but seek to make it conform to their selfish desires and needs, regardless of the exigencies of the public health. The passage of a basic science statute on the assumption that thereafter these persons can be permanently committed to its actual observance, or even to its theoretical acceptance, is to a large extent an attempt to deal fairly with persons on the basis of their really believing that they have substantial grievances, and honest intentions, in the promotion of the public health, whereas they have only the selfish object of setting themselves up in a profitable business with the least possible expense and trouble without regard to the public welfare.

SEEKERS FOR SPECIAL PRIVILEGE

No matter what the requirements of law are, or how easily attainable any standard of proficiency required for admission to the enjoyment of its benefits, there are persons seeking its privileges who are not willing or able to qualify to receive them; but such persons desire, nevertheless, to have all of the privileges and benefits of the law to which they do not conform. However meager may be the qualifications required for admission to the enjoyment of the privilege of practicing the occupation of healing the sick, there are always those seeking the right to follow that occupation who are not willing or able to meet the legal requirements, but who, notwithstanding their want of qualification, seek the enjoyment of the benefits conferred by the law on legally authorized practitioners and contrive by one kind of means or another to hold themselves out to the public as doctors.

POINTS OF ATTACK IN BASIC SCIENCE LAWS

One does not have to frequent legislative halls long to ascertain that no proposition is admitted by everybody to be basic. Substantially every embodiment of legislation is constantly attacked by somebody. Some minds are utterly lawless and unconforming by nature; and others act only on selfish grounds in refusing to accept propositions regarded as fundamental by most of mankind. These rebellious minds make most of the trouble in efforts to agree on a basic proposition for legislation.

It is not enough to assert, even by legislative enactment, that all practice, both nonsectarian and cult, is based on fundamental sciences, because some cults maintain, and will continue to maintain after the passage of any basic science statute, that the dogmas of their particular cult may be administered without knowledge of the sciences called basic.

DENIALS OF ESSENTIALS

For instance the chiropractor not only denies that diagnosis is necessary, but denies that any one of the so-called basic sciences is necessary, and asserts that his peculiar manipulation of the spinal column is pertinent to the conditions created by every disease, and that, therefore, there is no need of knowing anything about the disease with which any patient is afflicted. The passage of a basic science statute will not change the mind of a chiropractor! He will continue to conduct his practice in violation of the basic science law, as he has done in violation of all the other laws; and he will continue to haunt legislative halls to procure amendments to all of the statutes, whatever you may call them, and whatever may be their propriety, allowing him to go along in his practice with the kind of information that he happens to have.

OBJECTORS TO ANY RESTRICTIONS

In other words, there will be the same assault on the basic science law by quacks that has heretofore been made on every other law that has for its object the maintenance of definite standards. The question will always be with us: What sciences are basic? The contention will always be with us that most of them are not. If it were now possible to secure unanimity among all of the practitioners of healing on the proposition that certain sciences are basic, this unanimity would not last long, because somebody, not having the ability to make himself proficient in the sciences declared to be basic, would come forward and urge that the maintenance of such standards is oppressive to him and his patients; and that he ought to have the right to conduct his own practice in his own way, so long as his patient is satisfied; and that there should be no interference between him and his patient by the state; a proposition that is denounced by everybody who knows anything about the maintenance of public health, but which will always find acceptance by somebody having the authority to participate in legislative enactments.

SELECTION OF EXAMINERS

The examiners are probably the most important element in the scheme embodied in the basic science statute. Cults, and the teachers in their schools, have from the beginning charged that the examiners of the nonsectarian boards have dealt unfairly with their applicants and purposely prevented them from passing their examinations. There is no foundation for any such charge. Their applicants manifestly to a large extent have not had the educational qualifications necessary to enable them to pass reasonable examinations. Nevertheless, since the examiners are chiefly doctors of medicine from the more famous medical schools, many legislators have been induced to harbor doubts as to their disinterestedness. Hence we see this wise attempt by the formulators of the basic science statutes to get examiners manifestly destined to be impartial in the absurd controversies that have been developed.

Minnesota provides that two of the examiners shall be full-time paid professors appointed by or under the authority of the University of Minnesota, and that another shall be a doctor of medicine and surgery, another a doctor of osteopathy, and another a doctor of chiropractic. This classification of examiners simply establishes the composite board that we have known for a long time, with all of its defects, and particularly with its express recognition of a legal status for cults, and carries into the basic science law the worst of the evils for the eradication of which the basic science statute has been proposed.

Nebraska provides that no examiner shall be a person licensed to practice the healing arts or any branch thereof. While this provision may obviate every basis for the charge of prejudice, it removes the whole examining system from the administration of the persons who know most about the doctor's need for, and his application of, the knowledge of the various basic sciences. This type of examiners certainly removes the practical professional touch from the examinations, and substitutes the mere scholasticism of pure science. The effect of such a revolution in physicians' examinations cannot be definitely foretold, but may be imagined.

Washington provides for the appointment of five persons, learned in the particular basic sciences, from the faculty of the University of Washington and the Washington State College, and probably has made the best provision for establishing the examination on a purely scientific basis, separate and apart from any dogma.

SUBJECTS NAMED AS "BASIC SCIENCES"

The Wisconsin law names anatomy, physiology, pathology and diagnosis as basic sciences. The Minnesota statute names these and adds bacteriology, hygiene and chemistry. The Nebraska law follows Minnesota. Wash-

ington follows Nebraska's list, but excepting bacteriology. The action of these four states in determining what subjects are fundamental indicates the difficulty, if not the impossibility, of agreeing on the first requisite of the basic science statute. But that is only one difficulty in a bad situation. It is apparent that no one of these states has listed all of the subjects that are really basic in the preparation of the student for the work of the physician. None of these states includes obstetrics, which will hardly be denied a place among the basic subjects. Neither does any one of them include even the most elementary phases of surgery, such as setting a bone, or doing any one of a score of things necessary to be done by every physician in general practice from day to day. Nor does any one of the states include poisons or their antidotes, or contagious diseases, unless they are meant to be coralled under hygiene or chemistry, or another of the subjects capable of extension indefinitely to include everything.

Recognizing Cults

The Nebraska law provides for separate licenses for persons practicing medicine and surgery, persons practicing osteopathy, and persons practicing chiropratic, a scheme which not only tolerates but legislatively creates cults, and not only tolerates and creates them, but provides for unequal professional training among them.

Nor does Washington do any better, since it provides that the examiner shall conduct "examinations of all persons applying for licenses or certificates for practicing medicine and surgery, osteopathy, osteopathy and surgery, chiropractic or drugless therapeutics," thus not only recognizing cults, but establishing a legal classification of them that is probably the worst that has ever been contrived.

Cults Seek Commercial Success

If a basic science statute requires that a cult physician have sufficient knowledge of certain sciences to safeguard the public from the dangers of allowing uneducated physicians to practice—a supposition that we have to make in order to give a material reason for passing the basic science statute—we may ask why any other examination should be required by examiners representing a particular cult. For illustration, in the case of an applicant, under the basic science statute, who seeks admission to the chiropractic cult, any additional requirement by the examiners of that cult would not be material in the interest of the public health; so, therefore, might we not omit it, so far as any requirement of law is concerned?

The necessary answer is interesting to contemplate. The additional appearance before the chiropractic examiners is insisted on by the proprietors of the chiropractic schools in order to keep the cult going and the students coming. I dare say that if there was no profit in conducting the schools of the cults, the cults would languish and die, all appeals for legislation in their behalf would cease, and a single standard of intellectual proficiency would be unopposed. In other words, the strength of a cult is not in any new idea possessed by its originators or devotees, but in the commercial success of the schools that make money out of it.

Hold to Fundamental Principles

It is my view that the basic science statutes thus far passed are not strongly indicative of sure tendencies in the direction of better conditions for conserving the public health.

I admit that the condition created in a state by multiple boards is intolerable, and that every method that will ameliorate it ought to be carefully studied and, if possible, adopted. But when a new method of accomplishing this thing is suggested, it is important to consider carefully whether the new method will actually produce an improved condition, or whether, in the long run, it will simply fasten the vices of the cults on us more firmly and more definitely. It is not wise to abandon fundamental principles for what seems an immediate improvement, if the improvement can be but temporary, and if in the long run the expedient adopted will but weaken the public demand for the best service by the most carefully educated physicians. Rather than accept the examination, for instance, as the only test of training and instruction, or accept only a few of the necessary sciences as basic, with the consequent abandonment of proof of knowledge in many other subjects that are of the highest importance in consideration of public health, is it not far better for the educated physicians of the country, instead of compromising eternal principles of justice and efficiency, to stand by those principles and, if necessary, go down in defeat in warfare with the quack, and stay in defeat until the people wake up to the true conditions that confront them, and finally, as they always will, come to the acceptance of the principle that is fundamental, and that will supply the relief that evil conditions demand? I think so.

While I am willing to make the experiment of promoting basic science statutes in those states that have multiple boards, I am not willing to consent to a basic science statute that ignores the fundamental principles for supplying educated physicians to the country, or that yields our insistence on their importance merely to avoid a controversy with the cults. The penalty of such a compromise with the cults is too great to be willingly borne. It seems to me that thus far the best of the basic science statutes is merely a feeble step in the direction of forcing the cults to require some more or less inconsequential additional knowledge in a few subjects with the possible effect of deluding the public into the thought that, having passed the basic science examination, the physicians produced by the cults are as good as any other physicians because they bear the stamp of legal approval. Is this not complete capitulation to the cults on basic principles that ought not to be surrendered? In passing such a basic statute are we not paying too high a price for the appearance of having made somewhat better physicians out of persons who have no right to the physician's status in the law or in the judgment of the community? These questions indicate to me the line of thought that ought to be directed toward the present movement for basic science statutes as a scheme for ameliorating the vast evils of the present wrongful recognition of the cults by law.

Single Standard of Professional Training for All Healers

All of the present statutory incongruities and evils in licensing physicians could be avoided by the simple legal requirement that all healers be educated under the same standards of proficiency, and that there should be *no special privilege* given to the followers of any cult to practice healing on exemptions from this single standard of reasonable professional training. Under such a system there would be no cults, because the selfish reason for them would be gone, and all doctors holding themselves out to the public would place the emphasis on diagnosis, and out of the world's category of therapeutic agents would cause to be applied to each particular disease that curative agent possessing the best remedial possibilities. This happy condition the people are entitled to reclaim by the enactment of statutes in conformity with the facts of life and the principles of reason.

SAFEGUARDS AGAINST UNQUALIFIED NEEDED

Long observation has convinced me that the principal obstacle to adoption of wholesome laws requiring all practitioners of healing the sick to be equally qualified before engaging in their occupation is the fact that throughout the country thousands of persons are following this profession without suitable preparation for it, some of them in conformity with existing statutes, but most of them in contravention of them. Not having made any reasonable effort to qualify themselves, they know that they could not continue to receive emoluments from their practice, and make their living out of it, if they were compelled to show possession of even elementary qualifications. Hence they oppose a uniform legal standard of reasonable educational requirements for all doctors.

Such persons could receive no credence from the people, or from legislators, if they should disclose the ignoble reason for their opposition to wholesome laws, because both the people and their legislators naturally favor the restriction of the practice of healing to persons properly qualified to perform that service. Therefore, these unprepared healers conspire to conceal the real questions from the people, to set up false issues, and to lead legislators away from fundamental principles to invented scandal, fraudulent misrepresentation and false theories of both law and medicine.

Following the legislative program of making the worse appear the better reason, concealing the fact that their opposition to wholesome legislation is in reality based on their own deficiencies, they strive to appear to be honestly placing their opposition on worthy grounds. They pretend to be devoted to the public welfare, to justice and to progressive development of science.

These pretensions are made to conceal the real object, which is to maintain inferior legal standards of educational requirements as a special privilege to persons not willing or able to comply with reasonable standards, or to proprietors of inferior schools bidding for unprepared students, unequipped to teach the subjects of a proper course in healing the sick or to compete with good schools in giving the same courses of study.

The untutored healers succeeding financially in passing themselves off to the people are numerous. All of them are opponents of reasonable educational standards. Their own numbers are augmented by numerous persons who for one reason or another champion their alleged cause, deluded patients, dealers in proprietary medicines and their beneficiaries, opponents of vaccination, of vivisection and of inoculation, fakers, quacks, founders of new kinds of propaganda and organizers of new cults. They fight together to retain their profitable ventures, feeling that they have a common cause.

OPPOSITION FROM MERCENARY SELF-SEEKERS

The most active opponents are the proprietors of the low grade cult schools which assume to make doctors out of ignorant persons in a few months. These schools are bonanzas. They gather in armies of students who pay high tuition fees. They turn out armies of graduates for whom places to ply their frauds profitably must be provided in order to keep new students coming. A reasonable standard of educational requirements would kill these geese that lay golden eggs. Their only attraction is the speed with which they convert ignoramuses into doctors without bothering them about studying diseases or the methods of curing them. These schools can stay alive only under laws that make it possible for their graduates to hold themselves out to heal the sick without having even elementary scientific knowledge of the human body. The proprietors of such schools, therefore, are the more strenuous opponents of a reasonable single legal standard of educational qualifications for all persons holding themselves out as engaged in healing diseases.

Joined together firmly in an organization for promoting their selfish purposes, exaggerating their voting strength and proclaiming their disposition to use it, misrepresenting their educational qualifications and their ability to heal the sick, and deriding educated physicians by venomous and prejudicial scandal, all of these opponents, unmolested by organized opposition from any source, persistently and continuously use every known influence to defeat proposed legislation for erecting reasonable standards of professional training. As long as they are unopposed or weakly opposed they will succeed; when properly opposed their selfishness and weakness will be made known and in the long run they will fail.

NEED FOR ORGANIZATION IN THE MEDICAL PROFESSION

Those who have the public health in view and want to succeed in this contest will have to make a more vigorous fight. They must organize to educate the people and to inform legislators. They must spend their time and money more freely in presenting the public's cause to the legislatures of the country, and, indeed, to the courts, too, which also require ample arguments on the cases before them. The persistent, the vigilant, the crusading men win. It is unfortunate that truth has to be thus enforced, and that it is not self-evident. But error propagated by money, enthusiasm, and a not too scrupulous regard for facts often—in some fields generally—overcomes truth, which, thus crushed to earth, only after a long period of time will rise again. Those who would give the public better laws, if they would succeed, must not be content with merely stating their case scholastically, but they must organize to propagate it and then enforce it and compel attention to it by the practical methods everywhere influential with men, not only today, but tomorrow, and year after year, until the truth is permanently embodied in the law as the settled policy of the state.

Structural Scoliosis

Leo S. Lucas, M. D.

Read before the eighth annual convention of the American Physiotherapy Association, Portland, Ore.

The Greek word for scoliosis, meaning to bend or twist, was first used by Hippocrates who lived four centuries before the beginning of the Christian era. His use of the word was apparently to designate a lateral form of the spinal curve supposed to be due to dislocation; the forward curve being called lordosis, the backward curve kyphosis.

The method of treatment in that day was very crude. A patient with a spinal curve was tied by the legs to a ladder and the latter raised, then dropped to the ground, striking on one end, thus tending to straighten the spine, or such patients were put into apparatus to make extension and pressure on the prominence. Hippocrates also suggested putting one foot on the hump, or using a long wooden lever, but one finds no mention of any attempt of retention and the reason for this is that all treatment was based on the supposition that the affection was due to a dislocation which demanded reduction only.

For two thousand years following Hippocrates there was very little written concerning scoliosis. About 1150 A.D. Albukasis made a significant statement and one probably based on wide clinical experience: that no one could cure curvature of the spine. On the whole that is apparently the general conception today as regards structural scoliosis in the anatomical sense. Even during the fifteenth and sixteenth centuries it was still thought that curvature of the spine was due to a dislocation of the vertebrae.

The first autopsy of a scoliotic case was reported in 1646 without apparently clearing up the matter. Glisson writing of rickets in 1660 described the spinal curves due to it and suggested as treatment gymnastics or suspension. Glisson's suspension was from axillae, head and hands, by which the children were slung and allowed to play in the air, which he said they did with great enjoyment. The head sling proper dates from Nuckins in 1696 and was devised for the treatment of wry neck.

Andrie in 1741 wrote of scoliosis mentioning high heels, poor posture, bad sitting positions and faulty attitudes among the causes of scoliosis. He suggested gymnastics and apparatus, such as the whale bone corset as a means of treatment.

In 1779 Percival Pott made a very distinct step in publishing his essay on "The Palsy of The Lower Limbs in Consequence of a Curvature of The Spine." In this work he took out of the unclassified group of affections known as curvatures of the spine those posterior curves caused by spinal tuberculosis. His classical description of spinal tuberculosis was so accurate that thereafter all posterior curvatures of the spine were classed as scrofulous disease of the bone and not as dislocation.

During the middle of the eighteenth century much attention was paid to the treatment of scoliosis but very little investigation into the etiology, mechanics and anatomy was done. A great variety of braces, corsets, beds especially constructed, chairs, slings, swathes, belts, levers and the like were invented but there is very little mention of gymnastic treatment. However, gymnastic treatment of scoliosis was mentioned and used as early as 1600 A.D.

Henry Ling who died in 1839 founded a system of gymnastics known as the Ling system or Swedish movement treatment. An institute under the supervision of the Swedish government was established in Stockholm and Ling was its first president. A paper advocating gymnastics treatment was published by Langgard in 1868 and books and monographs followed in rapid succession. Gradually the gymnastic treatment came into its own and crowded out the apparatus treatment until today it constitutes the bulk of scoliosis treatment both in this country and in Europe.

Lewis Sayer advocated the treatment of spinal curvature by self suspension and a plaster of paris jacket. The jackets were removable, allowing for daily gymnastic exercises. His treatment was mild and ineffectual but was really the beginning of the modern idea, i. e., the combining of the physical training with the retention apparatus.

Calot was the first to advocate the forcible correction of spinal curvature by means of the plaster cast. His plan won a great many adherents and during the early part of the twentieth century a good deal of experimental work was done and there was much published work upholding the forcible corrective methods. A great variety of methods were devised. Jackets were applied with the patient on the face, on the side, on the back, with the spine flexed, with the spine hyper extended, on simple hammocks and in complicated apparatus, the whole idea being to hold the spine in an improved position for a long period of time.

Rapid progress has been made in the last two decades. The etiology has been fairly well worked out. Treatment has advanced. Operative procedures have been devised and advocated. There have been depressive periods in which many have despaired of treating these cases. The treatment is far from being standardized. Scoliosis is still one of the greatest problems presented to the orthopedic surgeon, the majority of whom are willing to steer clear of these cases.

The term scoliosis may be defined as a lateral deviation of the spine to one side or the other with rotation of the vertebrae. There are two classes of scoliosis: (1) The functional, total postural or false scoliosis and (2) the structural, organic or true scoliosis. In the first type the normal anatomical structure of the spine is not changed, while in the second there are definite bony changes resulting in fixed deformities. There are many different types of scoliosis, the larger percentage falling under four headings:

I. Congenital Scoliosis

Congenital scoliosis is that form in which the condition is present from birth or soon after due to congenital malformation of the vertebral bodies usually consisting of wedge-shaped vertebrae with the resulting early curves. These cases as a rule have a tendency to break down rapidly if not treated early and are very dangerous because of the damage done in infancy and early childhood before the child begins to walk. The deformity is usually noted late by the immediate family.

II. Rachitic Scoliosis

Rachitic scoliosis follows in the wake of acute rickets.

It is caused by static forces brought to play on weakened vertebrae. The curvature is usually mid dorsal. As a rule rachitic scoliosis yields to treatment if correctly applied and provided the treatment is started early before a severe curve develops.

III. Paralytic Scoliosis

Anterior poliomyelitis can be ascribed as the cause of the largest percentage of all spinal curvatures. Hibbs of New York goes so far as to say that in his opinion scoliosis is always caused by infantile paralysis except in a few obscure cases. Scoliosis due to paralysis is the most severe of all the types. In a series of 700 cases studied in Steindler's clinic over ninety percent were found to go on to increased deformity unless checked by proper treatment. Less than ten percent become arrested by the development of muscular balance.

IV. Habitual Scoliosis

A large number of cases are placed in this group whose causes are unknown or not recognized. In this class falls a great many cases wherein static causes are the factors contributing to the spinal curvature.

Separated from this general classification are a great many sporadic tyes among which are spastic scoliosis, empyemic, pleuritic, traumatic, sciatic, hysterical, etc.

Lovett has shown that pure lateral deviation of the vertebral column is always accompanied by rotation of the vertebrae around a vertical axis in such a way that their bodies look toward the convexity of the curve, while the spinas, laminae and articular processes are directed toward the concavity. The bodies of the vertebrae become wedge shaped from side to side in conformity with the curve. The muscles and ligaments are also altered in length. Such deformity of the spine is accompanied by disturbance of the whole balance of the body. In the thorax the ribs accompany the transverse processes so that they form a convexity, the "rib hump," or gibbus on the same side as the convexity of the spine. As seen from the front there is flattening of the ribs on the side of the convexity and projection on the side of the concavity. The thoracic and abdominal viscera are distorted and displaced.

The general grouping and arrangement of the muscles in their relation to the spine has an important practical bearing on scoliosis. The spine lies toward the back of a more or less cylindrical muscular tube of which the abdominal muscles form the front. Of muscles directly attached to the spine there are two varieties. First, muscles running from one part of the spine to another and to the head. Second, muscles running from the spine to the pelvis or shoulder girdle. The abdominal muscles by their attachment to the thorax, which is comparatively rigid, have an action on the spine. By the combined action of these three the erect position is maintained, or any variation from the normal is accomplished. Any mechanical stress or change brought to bear on either the thoracic cage, pelvic girdle or spine has a direct influence one to the other.

The thorax represents a comparatively fixed cage inserted in a structure quite movable above and below it. Muscles attached to the thorax are therefore indirectly attached to the spine. The comparative rigidity of the thoracic part of the spine is due to the fact that the majority of the ribs are attached posteriorly between two vertebrae, that they pass forward to be also attached to the sternum, and that the whole structure is one well calculated to prevent physiological side bending or extensive forward or backward motion in that region. The cage must therefore largely move as a whole.

It is generally considered that the dorsolumbar joint is a dividing point for important muscular origins and insertions above and below it. For example, the psoas muscles originate largely below it; the trapezius above it. For this reason it is a weak and movable part of the spine. Another reason is that the large muscles passing from the rigid thoracic cage to the more or less fixed pelvis act as a lever over the weakened dorsolumbar junction. Likewise the cervicodorsal and sacrolumbar junctions are weak movable points.

From this we can easily see why the breaking point in scoliosis or decompensating points are at these junctions. The largest percentage of breaks in compensation fall at the dorsolumbar. When this occurs there is a marked list of the body to one side and the muscles quickly lose their power to compensate. As stated before it can be seen from the above that any mechanical stress or change brought to bear on either the thoracic cage, pelvic girdle or spine proper has a direct relation one to the other.

In a well-established fixed scoliosis the whole of the body is involved in the disalignment. There is not only rotation and list of the body but the pelvis is tipped and rotated, the hips are involved—the one on the convex side of the curve going into abduction and the one on the other going into adduction. The pelvis is included in lumbar rotation. It is twisted backward on the convex side turning the hip in inward rotation, while on the concave side it is twisted forward turning the hip in outward rotation.

Present methods of treatment have for their purpose the correction of the original curve by the application of direct force to the deformed portion of the spine. Such men as Lovett, Bradford, Abbott, McKenzie, Forbes and Kleinberg have been staunch advocates of this method and they have devised many ingenious methods of treatment. At times, however, these men have been free and willing to admit the great majority of failures resulting from this form of treatment.

The report of the scoliosis committee of the orthopedic association considering the methods of Lovett, Abbott and Kleinberg states that no cases of over correction or complete correction of the elements of the deformity had been found, but that in mild cases of undoubted scoliosis and perhaps in some moderately severe cases considerable degree of correction had been achieved.

Wellstein has shown that forcible correction of a structural scoliotic spine is possible. But the traction force necessary (200 pounds or more) forbids its practical application. Therefore correction of structural scoliosis in the anatomical sense may be considered impossible.

Recognizing the impracticability of forcible correction of the primary curve itself, Steindler has worked out the idea of substituting for alignment by direct correction the principle of indirect alignment by compensation. The development of counter curves above and below the original curve is a characteristic feature in the development of scoliosis. Recognizing nature's attempt to develop secondary curves to maintain equilibrium, Steindler proposes to aid nature and form these secondary curves early and more quickly.

We all know that non contracted or non structural cases may recover where the muscular equilibrium is only temporarily abandoned. These cases are always in danger of breaking but many of them recover without treatment and a great many recover under proper physiotherapeutic control.

The muscular equilibrium is definitely lost in structural scoliosis and this equilibrium will only return if the spine can be completely returned to normal. Steindler states that we have no more right to expect a partially corrected spine to recover than we can expect a partially

corrected club foot to go on to complete correction. We all know that unless a club foot is thoroughly over corrected it immediately goes back into deformity more marked than the former. The condition, therefore, becomes more resistant to further treatment.

A spine that is compensated is one in which the counter curves or compensation curves equal the primary curve. When a spine is compensated the alignment of the body is normal although there is a shortening of the trunk which may be marked or only slight. A few scoliotic spines because of compensatory curves and recovery of muscular equilibrium become arrested, but a larger percentage cannot stand the stress and strain of internal and external forces, compensation breaks and the spine then becomes decompensated. The effect of decompensation is a strong body list to the convex side with increased rotation and a movement in the opposite direction of the pelvis.

The treatment instituted by Steindler is divided into three periods:

(1) Mobilization of the non-rigid portion of the spine by gymnastics, and traction on the Bradford frame.

(2) The maintaining of the compensatory curves by plaster of paris fixation until they are definitely established.

(3) Definite maintenance of the regained alignment.

When a child is admitted to the Shrine Hospital for treatment, measurements are taken as well as photographic and X-ray records. He is then placed on a Bradford frame with head and pelvic extension. We are of the opinion that the Bradford frame is a valuable adjunct to the gymnastic treatment. From two to three hours daily are spent in the gymnasium where exercises and manipulations are carried out consisting of stretching, bending, arm and shoulder girdle drills, back and abdominal exercises, active shifting of the body to the concave side, Klapp's creeping exercises and breathing exercises. In a fairly severe case this period of treatment may take from two to four months and is continued until as much compensation as possible is secured.

The second period of treatment consists in the application of a series of plaster casts in order to stabilize the correction so far secured and also by proper padding over the gibbus to further increase the secondary curves. These are applied by suspending the child with the head sling, elevating the arm on the concave side and abducting the hip on the same side. The patient then shifts carrying the trunk strongly toward the concave side. The pelvis is immobilized by including the thigh on the concave side in the plaster. The shoulder on the opposite side is also included to prevent rotation.

If, after this period of treatment, the body alignment has been secured and the muscles are strong another period of intensive gymnastic training is given and the patient discharged with or without a support and instructed to carry out the exercises at home. If, however, the muscles are weak as is usually found in poliomyelitis, fusion of the spine is advocated. Fusion is more successful in those cases where the alignment is good but it may be resorted to in cases not completely compensated for it offers the best hope, especially in paralytic cases. A brace should be worn for from six months to one year following the operation.

Scoliotic cases should be examined carefully and complete records kept. Not only should they be measured, the asymmetry noted but photographic and X-ray records made often and frequent comparisons made to determine the progression of the curve. We require outpatients to return to the clinic once a month for examination.

Shriners' Hospital for Crippled Children, Portland, Ore.

Exercises for the Treatment of Scoliosis With Special Attention to the Development of Compensation

Dorothea Sorenson

Read before the Eighth Annual Convention of the American Physiotherapy Association

Four types of scoliosis are recognized by Dr. Steindler in his discussion on the treatment of scoliosis by the compensation method:

1. The beginning or mild physiological curve not yet in the state of structural contracture, treatment of which leads to complete overcorrection and subsequently to the establishment of normal symmetry by active muscle control.

2. The moderately advanced structural scoliosis in which complete compensation is obtained and again maintained by active muscle power.

3. The far advanced structural scoliosis with considerable lateral and rotatory deformity and body disalignment, in which compensation is not obtainable and correction cannot be effected by compensation methods.

4. The paralytic group in which compensation can be obtained but not maintained.

The role of exercise in these respective types necessarily varies according to the prognosis and general aim in treatment. Yet, certain exercises can be used for most any of these types if modified to meet the individual case.

These various types of cases also usually present similar habits of posture and muscle contractures which must be overcome before proper body alignment or compensation can be established. Specifically, I refer to general faulty anterior-posterior posture, such as forward head, kyphosis, depressed chest and restricted chest expansion, increased pelvic tilt with its accompanying lordosis and relaxed abdomen, and tight hamstring and pectoral muscles.

In general, then, the exercises may be classed as follows:

1. Exercises for the purpose of increasing bodily mobility and strengthening the general musculature.

2. Exercises directly productive of compensation.

3. Exercises to develop the necessary subjective motor control with which correction or compensation can be maintained.

With this in view the following list of exercises has been worked out. It must be kept in mind that this is only a working outline, modifications and adaptations of which must be carefully worked out to meet the needs of each patient. (Only by seeing the exercise tried by a patient can you determine whether or not it is a suitable one.) These exercises in turn include weight-bearing and non-weight-bearing exercises, the predominance of either type also being determined by the individual patient.

It must further be remembered that the exercises are not listed in the order in which they should be given to the patient.

I. Exercises Increase Mobility and Strengthen the General Musculature

A. Lying.

1. Supine Lying.

a. Knees bent, feet on table, double knee raising to chest and return.

b. One knee bent, leg raising firmly to chest, slowly return.

c. Bicycle, slowly making big circles.

d. One-half somersault. (Grasp the table with the hands so as to fix the chest; draw the knees firmly over the chest as in a backward somersault and balance them in the air in such a position as not to put too much weight on the upper back. Return slowly to the table without allowing the lower back to arch.)

e. Alternate knee bending, stretching and slowly lowering.

f. Double knee bending, stretching and slowly lowering.

g. Arm circumduction, emphasizing the backward pull to stretch the pectorals. May be done with one or both arms.

h. Breathing, with concentration, to full expansion of the upper chest.

i. Lying on sandbag—bag usually placed about the level of the inferior angle of the scapula.

j. "Sit-up." (Come to a sit-up from the lying position, arms folded on abdomen, shoulders kept flat.)

2. Prone Lying.

a. Bar raising overhead, keeping elbows straight and holding the hands as close together as possible.

b. With head hanging over the edge of the table, head raising with or without resistance.

c. Head and shoulder raising, adducting shoulders at the same time.

d. Abdominal retraction.

e. Leg raising and pulling toward the side of dorsal convexity (left leg when there is a right dorsal curve).

3. Side Lying (on side of dorsal concavity).

a. Leg raising straight upward as far as possible.

b. Shoulder raising straight upward as far as possible.

B. Sitting.

a. Long sitting, forward bending, touching toes, followed by upper back stretching with hands on neck.

b. Long sitting, forward bending, grasping ankles. Keep hold of ankles and bend elbows as you bend forward.

c. Upward stretch with hands on the table close beside you. May place hands on hips or neck instead.

d. Pectoral stretching, passive. This may be taken in the long sitting or regular sitting position. The patient places hands lightly on his shoulders and the stretch is done with a circular motion, forward, upward and backward.

C. Standing.

a. Forward bending, touching floor, with knees straight. This may be done first with feet astride.

b. Aeroplane, unilateral or bilateral. Feet astride, arms at side, horizontal. Twist and swoop down and touch left toe with right hand. Same to the opposite side.

c. Hamstring stretching, with hands grasping ankle of one foot, which is forward. Knees should be kept straight during forward bend.

d. Side bending, with feet astride. May or may not use pressure with the hand on the thoracic convexity.

e. Trunk twisting, with feet astride. Keep hips still.

D. Kneeling.

a. Place hands on floor well out in front. Pull chest

down toward floor until back is fully extended. It is necessary to guard against hyper extension in the lumbar region in some cases.

E. Swimming.

The patients are each instructed as to the best strokes for them to work on. For the majority of cases I use symmetrical strokes, as I use this for general strengthening purposes mainly.

II. EXERCISE TO PRODUCE COMPENSATION

A. Lying.

1. Prone lying, leg raising upward and toward the side of dorsal convexity as given above.
2. Prone lying, pelvic rotation, passive or assistive. The patient grasps the table to help fix the chest, which is also strapped over the mid point of the curve. The physiotherapist places one hand under the hip and, grasping the legs, twists the pelvis toward her.
3. Prone lying, pelvis trapped. Twist the shoulders in the opposite direction from the pelvic twist. The patient usually needs help in this, for a time at least. Better localization can be attained usually by applying pressure to the point of thoraeic convexity. The patient may extend one arm overhead if desired.
4. Roll. This must be scheduled to meet the individual need very carefully.

B. Sitting.

1. Spring sitting, with arm on low shoulder side, extended overhead.
2. Knees spread, shift to side desired, bend forward and twist to side of dorsal convexity.
3. Leg on side of dorsal convexity, abducted, with foot braced on the floor, bend to side of dorsal convexity, with hand pressing on the side of convexity.
4. Long sitting, feet astride, shift and twist toward the side of convexity.
5. Same with feet crossed.

C. Standing.

1. Aeroplane to side of convexity, with or without heel raised on the side.
2. Aeroplane with one foot forward.
3. Stride standing side bending.
4. Shift.

D. Suspension.

1. Low shoulder, reaching high on bar, reach back with leg on side of concavity and stretch to that side.

E. Crawl.

The arm on the low shoulder side is placed forward, the knee on side of dorsal convexity is placed forward and the body is twisted backward slightly toward this side. The exact placing of feet and hands must be decided by trial.

III. EXERCISES TO DEVELOP SUBJECTIVE MOTOR CONTROL

A. Lying.

1. Back flattening, by tipping the pelvis and decreasing lordosis: a, with knees bent; b, with legs straight out.
2. Neck flattening, holding the lower back flat.
3. Abdominal retraction.
4. Breathing with pressure applied to points of convexity.
5. Breathing with abdomen held retracted.
6. Prone lying, shoulder adduction.
7. Prone lying, "shift" and raise the shoulders, chin in.
8. Head raising, chin in.

B. Sitting.

1. Shift.
2. "Goose-neck" exercise, chin retraction with extension of cervical vertebra.

C. Standing.

1. Posture training.
2. Shift: a, with hands on hips; b, with hands at sides.

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Functional Paralysis

F. J. Ernest, M. D., Neuropschyiatrist

Read before the eighth annual convention of the American Physiotherapy Association, Portland, Ore.

Paralysis is divided into two great classes—peripheral and central. By peripheral we mean that state of functional impairment of voluntary motion which results from disturbance of elements in the lower neuron or peripheral nerves. This means that the pathological process may be anywhere along the course of the nerve from its origin in the nucleus of the anterior horn of the cord to its motor end-plate. If this disturbance involves only part of the neurons composing the nerve trunk, it is designated partial, but if all the neurons are involved then it is said to be complete paralysis. Reflexes are lost, atrophy and trophic disturbances occur, and within sixty days complete reaction of degeneration has set in.

Central paralysis is also divided into two classes—organic and functional. In organic we are able to demonstrate changes in the nerve pathways somewhere above the nuclei-anterior horns, which are the origin of peripheral nerves. This lesson may be in the cortex, midbrain or spinal cord, but it must involve the upper neuron. It is differentiated from peripheral paralysis by the facts that reflexes are increased, atrophy and trophic changes do not occur, and the reaction of degeneration does not set in. The nerve pathways have been interrupted so that normal impulses can not get through. This brings us up to functional paralysis, the subject of this paper.

By functional paralysis we mean a state of motor inactivity not due to structural change or involvement of nerve tissue; i.e., the refinement of our technic so far has not been sufficient to make it possible for us to demonstrate any changes in nerve structure, nor do we expect to be able to demonstrate such a change, for the disturbance in function is not organic. There is really nothing the matter with either the structures or impulse. It is wholly the method of disposition of impulse. Let us compare the nervous system to a great railroad, having many trains, many tracks and a great central office. Trains will represent impulses or nerve energy; tracks, nerve pathways; and central office, the brain. Railroads for economic purposes have division points which represent nuclei or anterior horns of the cord. Trains are made up at these points for certain destinations, and central office directs their movements. Now, if, for any reason, the track is torn up between the last division point and destination—railhead, wharf, or whatever—then the train could not get through. This would be equivalent to a peripheral paralysis. If the destruction of tracks occurred between central office and the last division point, then we would have a central paralysis of the organic type, but suppose that a switch is open and the train after leaving central office moves out onto a perfectly good sidetrack off the main line, there is nothing wrong with the tracks, nothing wrong with the train, and so far as central office knows everything is moving along quite normally; yet the train does not arrive. This would be functional paralysis. By this comparison I have tried to show you that functional paralysis is not a conscious mechanism; that it is in no way malingering. Malingering implies conscious effort to deceive; in functional paralysis consciousness is itself deceived. When a faradic current has been applied to a motor point in a normal appearing extremity and normal action occurred, yet the patient denied ability to voluntarily produce the same action, you have no doubt been told by representatives of the general medical profession that you have proved malingering; that the patient could voluntarily move the structures, if he would. Of course, you now see that those statements were not really true. Consciously, this patient has no more knowledge of what happened than does central office when an unauthorized switch was left open and the train sidetracked. In neurology this sidetracking is called dissociation, and inasmuch as the sidetrack had to be already there before the switch was open, so in functional paralysis the mechanism, or picture complex, must have already been in the patient's unconscious field before the paralysis could have occurred. Functional paralysis never occurs in a high-type personality. Two conditions must be present and cooperate to produce functional paralysis. First, the patient must be that type which has never learned to meet and overcome obstacles at a personal sacrifice. He is the type who evades responsibility, tends to shirk duty, and is full of alibis. He is always looking for an easy way out, a reason for his failure that satisfies society; in other words, a reason or excuse that the world can see and know that with such an affliction it is impossible for him to work or provide for his family. This is one requisite, and the other is the mental picture referred to above, a picture of a paralyzed state stored away in the unconscious. Such a picture as is always developed in every mentality from immobilization of an extremity or part by the treatment of a fracture by placing the limb in splints, a cast or upon extension. This immobilized state for a long period of time teaches consciousness to dissociate or disregard impulses to these immobilized parts, and it later requires time after appliances are removed before normal reactions are resumed. This picture is never lost—just stored away; and when the picture happens to be a part of the mental equipment of a pathological personality, such as we have described above, all that is necessary for a conversion to take place, a functional paralysis to develop, is an intolerable situation to arise. Some difficulty that requires personal sacrifice, some obstacle that is easier evaded than removed; and lo! the unconscious throws open the switch and the train, or energy, leaves the main line and a complete dissociated paralysis of the conversion type occurs. Patient's ego is protected and the world sympathizes greatly and provides for him and his family, and so forth.

Now, what is the cure? Broadly, it is to make this tolerable paralytic situation more intolerable than an unparalyzed working situation, and the methods for such cure are legion. Whatever your method, first be sure of your diagnosis; then gain patient's confidence by showing personal interest. Convince him that you thoroughly understand his case and exactly the type of treatment that is indicated and also what the results will be. You must be firm and direct, kind and considerate, but not sympathetic. You must demonstrate to him that the paralyzed extremity is normal in its reactions, that it moves by electric stimulation similar to the one not paralyzed, and from day to day you must lead him forward by progressive active exercises, particularly calling his attention to his achievements and setting a new goal. It will be necessary for you to make positive statements as to the time when the successive goals will be reached and

that various aids, such as wheel-chairs, crutches and canes, will be discarded at these various times. To illustrate: One of our cases came to the treatment room on crutches, supporting the paralyzed leg and foot by a loop suspended from his waist and hanging down in the back, hooked under the heel of his shoe. Of course, this advertised to the world that his leg was paralyzed and useless, and although he otherwise looked physically fit and healthy the world excused him for not providing for himself and family. In fact, the world, or society in general, treated him as somewhat of a hero because of his cheerfully making the best of what appeared to be a very bad situation. Our first step was to remove this heel support and the second to limit his privileges. He was not permitted to leave the grounds until he was able to board a bus with his foot down. This he was able to do within a week and within another week we required him to get about without crutches, using only a cane, and next his cane was taken away. Within a month he was walking about quite well, going down town regularly and without support of any kind. About a week later he was discharged from the hospital as having reached maximum benefit. He opened a cigar store of his own and has since been doing well in that capacity. I last saw him at the American Legion meeting a week or two ago. There was no evidence of paralysis. In this particular case, we had excellent cooperation, not only by the patient and physical therapy staff but also by the surgeon who had supervision over him while in the hospital. It is often necessary that somewhat extreme measures be used in order that you may break through into consciousness. It is sometimes necessary for painful currents to be applied. These have two effects. First, to render the intolerable situation which originally gave rise to the conversion, or paralysis, more tolerable; and second, it makes it easier for consciousness to regain supremacy over the unconscious. Again referring to our railroad system, you first get the train back on the main line, and then close the switch. In this manner you will have performed one of the modern miracles. You will have cured a paralysis by physical therapy.

U. S. Veteran's Hospital, Portland, Ore., July 8, 1929.

Sinusoidal Currents and Their Use in the Treatment of Paralyses

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Read before the eighth annual convention of the American Physiotherapy Association, Portland, Ore.

Sinusoidal currents are little known and poorly understood by even those who are doing active reconstruction work. Empiricism has been largely responsible for their development, and hardly any form of physical treatment has received less thought from the medical profession. A fog of mystery surrounds the subject, no less dense to the physician than to the layman, and the result is often a whole-hearted condemnation of procedures which may be of great value, a loud denial that any good may come out of electrical stimulation of muscles. The term "sinusoidal" is used with so many varied meanings and connotations that any discussion of the subject must be preceded by a full explanation of what is meant.

The objective of all our efforts in the treatment of paralyses is a restoration of function to as nearly normal as the residual pathological changes will permit. The immediate attention of the physical therapist is directed toward improvement of vascularity and nutrition of paralyzed muscle, conservation of tonus and irritability, and preservation of the anatomical relations of parts affected. Joint motion must be preserved or restored, and fibrous contractures, ligamentous changes and bony deformity prevented or ameliorated. All this necessitates the provision of rest as the beginning point of all procedures, and we shall do well to remember Hilton's[1] plea for adequate rest in the intervals between exercise.

Stimulation of paralyzed muscles by electricity in any form is intended primarily to secure contractions of muscles within the limits of fatigue. Lovett[2] insists upon this point particularly and points out the difficulty of detecting the first signs of fatigue and the ease with which flaccid paralyzed muscles become over-tired. The presence of complete or partial reaction of degeneration characterizes lower motor neuron lesions and determines the course of treatment. The attempt is made to maintain as far as possible a state or normal tone and nutrition pending nerve regeneration, to preserve muscular irritability and to prevent atrophy and subsequent deformity. In upper motor neuron lesions the conditions are very different; the affected muscles are hypertonic, and hence are the deforming factors rather than their antagonists. Muscular irritability is above normal, and nutrition is usually fair, while atrophy is a minor factor. Here the object of any treatment is to aid in forming new habit patterns, new pathways for nerve impulses to take the place of old ones which are blocked or destroyed, and to foster a normal sequence of contraction and relaxation. The technic and application of sinusoidal currents must be very different in these two contrasting types of paralysis, and in both of them they must be considered as accessory to muscle training and re-education. Electrotherapy should be an integral part of every reconstruction department, and it is unfortunate that it has been thought to be a separate field.

The physiology of muscle is the basis of our attempts at restoration of normal function, and naturally occupies more of the thought of the physical therapist, since this is his chosen field. A review of older knowledge and a glance at some newer developments in the physiology of muscle may assist us in clarifying our ideas as to the rationale of electrical stimulation of muscles, and may perhaps give us better basis for the "faith that is in us." The development of the Faradic coil and of Galvanism gave to physiologists tools which have been of inestimable value in prying into the facts of muscle physiology, and electrical stimulation is a prime essential to all investigations in this field. It has probably given us more information regarding contractibility of muscle than any other agency, and the literature is filled with references to the electrical reactions of muscles. Yet, with all the wealth of fact, the clinician has been surprisingly slow in applying even the rudiments of this knowledge in the diagnosis and treatment of disease.

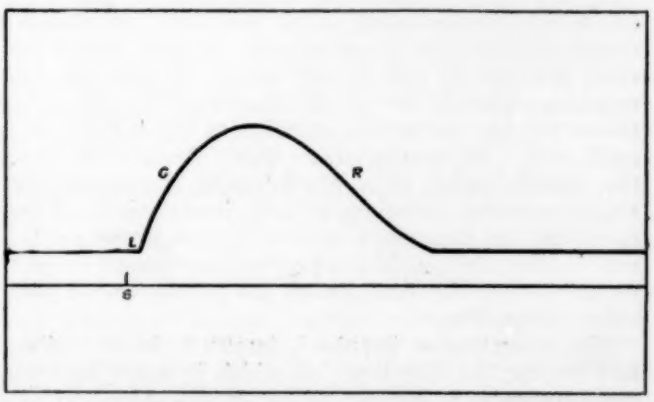

Fig. 1. Single muscle twitch response to single Galvanic shock. L—Latent period, C—Period of contraction, R—Period of relaxation, S—Stimulus.

The primary law of the electrical stimulation of muscle was established by Du-Bois-Reymond, and states that the change in amount of current from moment to moment is stimulating to muscle, and not the absolute amount which flows. When a Galvanic contact is made we elicit the contraction of the closing stimulus, which is manifested as a single muscle twitch, after which the muscle comes to rest and remains so until the contact is broken and a second lesser twitch occurs, the opening contraction. (Fig. 1.) So long as there is no variation of the current intensity in the interval, no stimulation occurs, even though ionic changes may go on to the point of injury or death of the muscle tissue through which it is flowing. If a Galvanic current is turned on very slowly and smoothly, even the closing and opening twitches fail to occur, and if we make and break the current very rapidly the contractions will be only partial. Granger[3] states that after 4,000 interruptions per minute the contractions begin to decrease markedly and at 6,500 they cease entirely, the muscle then being in a condition of complete tetany.

In the physiological meaning of the term, tetanus indicates a condition of sustained contraction due to stimuli repeated frequently during the period of contraction fol-

lowing a single stimulus. Successive stimuli during the latent period following the first single stimulus will give no more response than though only one shock were given. The tetanic contraction is characterized by a gradual rise of the curve to a plateau which represents the maximal contraction power of the muscle stimulated, and this condition of contraction persists an appreciable time after the repeated stimuli are stopped.

Fig. 2. Tetanus—a diagrammatic sketch. Asc.—Ascent. P—Plateau, A—Angle, R—Period of relaxation, S S—Stimuli, 50 interruptions per second.

(Fig. 2.) This is called the tetanic response and it varies in duration according to the duration of the repeated stimuli and the rate of stimulation. Fulton shows[4] that rates between 40 and 80 per second produce the best responses, while if the rate of stimulation is enhanced to above 100 per second the duration of the last response again falls. He further states that, "Broadly speaking, the muscle twitch is a physiological abstraction, for single responses seldom occur in the intact animal. Movements are the expression of more or less prolonged tetani." (Fig. 3.) This is of prime importance to us if we are to use electrical stimuli for production of muscular contractions.

The normal nerve impulse is known to be of a vibratory nature, the frequency of which is stated by most physiologists to be between 40 and 80 discharges per second for skeletal muscle. Piper's[5] figures have been the basis for further work, and Fulton[4] states that, "Thanks to the brilliant investigations of Lucas, Adrian, Pratt and others, many physiologists feel completely confident that all variations and gradations in muscular responses are explicable in terms of variations, on the one hand, of the *rate* and *duration* of discharge, and on the other of the *number* of discharging units (i. e., nerve cells)." Many factors affect the frequency of nerve impulses, particularly temperature, tonus, and fatigue both of the central nervous mechanism and of the muscle fibers. Smooth muscle receives impulses at a very much slower rate, about 6 to 16 per minute, and these impulses are conditioned by the local spread of stimuli through the primitive nerve nets of the myenteric plexuses.

The time-intensity relations of electrical stimuli have been recently investigated by the French school of physiologists, and following the work of Du-Bois, Lapique,[6] Bergonie and others it has assumed a prime importance to all who work with muscles. An arbitrary value for the strength of stimulation has been set at twice the threshold intensity. The amount of current needed to cause a barely perceptible twitch of a muscle is surprisingly constant, and nearly the same for all muscles, and this amount is called the rheobase of Lapicque. Twice the rheobase value is used in determining the duration time over which this strength of current must be applied to secure a maximal response, and the minimal effective duration time is called *chronaxie*. A stimulus which lasts a shorter time than the period of chronaxie of a muscle is ineffective, and so the strength of current must be greatly increased to compensate for too short a time period. This is the reason that very rapid stimulations secure imperfect responses in muscle, and that such stimuli are painful due to the necessary increase in intensity. Tinel[7] says that the ideal current for stimulation of muscle is one which causes a maximal contraction with a minimum of current strength. The less current we use, the less is the damage done to tissues, the less the skin effect beneath the electrodes, and incidentally, the more pleasant is the treatment to the patient. If the duration of a stimulus exceeds chronaxie time we get no more response than with one lasting only the minimal time.

The chronaxie of smooth muscle is much slower than that of skeletal muscle, and skeletal muscle which has lost its nerve supply rapidly approaches in electrical reactions the condition of the more primitive smooth muscle. The sluggish reactions of paralyzed muscles are commonplace to every technician. When reaction of degeneration is complete, a smooth, slow stimulus is needed.

To summarize the foregoing statements, a stimulus which is adequate for a skeletal muscle is one which lasts over the proper period of chronaxie for that muscle, and which is repeated 40 to 80 times per second according to Piper's figures for frequency of nerve impulses. Also a slowly changing intensity in accordance with Du-Bois-Reymond's law should give a more natural response than the tetanic contraction which the same intensity, shown graphically as a plateau with a sharp drop. A volitional contraction is characterized by a smooth, rounded curve,. and a gradual, smooth drop to the base line. Hence a current which will induce this natural, rounded curve of rise and fall should be the better one to use when exercising muscles by means of electricity, since it approximates the normal physiological response of a muscle to cortical impulses, and requires minimum current intensity.

The name sinusoidal is applied to a group of cyclic currents of low and medium frequencies, all of which

Fig. 3. Summation of muscle contractions to slowly repeated stimuli; the precursor of tetanus. Stimuli at rate of 14 per second.

follow approximately the form of the curves plotted from the mathematical sine formula. Because they are only approximations of the sine curve they are rightly called sinusoidal. An alternating current is truly a sinusoidal current, but most of the currents under this name are of much slower frequency. Granger[8] defines the sinusoidal current as, "A current which, starting from zero, rises in the form of a sine wave with gradual in-

crease in voltage and amperage until a certain maximum is reached, when without any pause or break it decreases in a similar gradual manner until the zero line is again attained, when, still without pause, the same process is repeated in the opposite direction below the zero line. This constitutes one cycle." (Fig. 4.)

Nomenclature is thoroughly mixed at present, but the primary basis of distinction is a difference in frequency of alternations. Common usage gives the slow or smooth

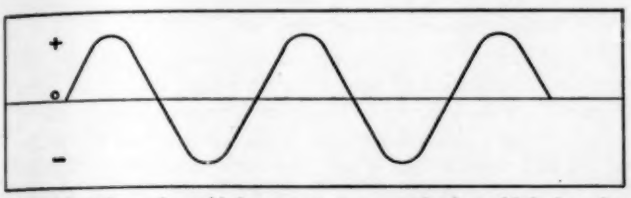

Fig. 4. Slow sinusoidal current, or smooth sinusoidal, 6 cycles per minute (Diagrammatic.)

sine and the rapid sine, but no two writers agree as to the limits of these two. The Council of Physical Therapy of the American Medical Association is at present engaged in a standardization of terms, which will aid materially in speaking of such agencies. The slow sinusoidal current usually implies a current which is varied at from 5 to 15 times per minute. It is sometimes called the Galvanic sine because the source of current is a battery or a motor-generator set which produces a smooth direct current and this is alternated slowly by an accessory motor-driven mechanism. Thus the resultant current has most of the polarity effects of the Galvanic current, each successive wave cancelling out the polar effect of the preceding one by reversal of polarity. The polar effects of the slow sinusoidal current are especially useful in stimulating smooth muscle and skeletal muscle with complete R. D., but are inadequate for stimulation of normal skeletal muscle because the changes come too slowly. Rapid sinusoidal currents may vary from 20 times per minute up to several thousand times per second. They are truly alternating currents and lose polarity effects in proportion to increases in frequency. They are adequate for stimulation of contraction in normal skeletal muscle or when R. D. is incomplete they may be of use, depending on the stage of regeneration and on the alternation frequency of the cycles. (Fig. 5.) Motor-generator sets are also the usual sources of rapid sinusoidal currents, although some workers utilize the alternating current from the commercial power mains, the amperage being reduced by means of a rheostat control. Commercial alternating current is apt to vary in

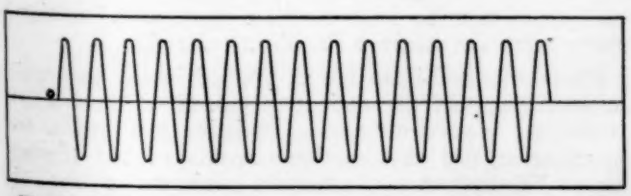

Fig. 5. Rapid sinusoidal current, an alternating current at 220 cycles per second.

intensity a great deal, and is usually of about 7,200 alternations per second, which is tetanizing in character, having thus little advantage over Faradism.

Surging Galvanic currents are produced from the usual sinusoidal machine by causing all the waves of each terminal to remain of the same polarity. This accentuates the polarity effect of the current and combines with it the contractive effect of the sine wave. They are applicable where the polarity effects of Galvanism are desired in addition to the contractions of muscle, and so have a limited field of usefulness.

A variant of the slow sinusoidal current is produced by causing the current to vary slightly by interposition of a coil or a secondary pair of armature brushes on the generator side of a motor-generator set. The resultant wave rises and falls smoothly as does slow sinusoidal, but in addition there is an added wave or riffle, which is termed the superimposed wave or riffled slow sinusoidal. (Fig. 6.) This current causes skeletal muscle to contract strongly with very little current. The superimposed slight variations in current intensity may be timed so as to correspond to the normal periodicity of nerve impulses to skeletal muscle, and thus we have a current which coincides quite well with the physiological principles which we have considered. It furnishes an excellent, graduated contraction which is most desirable in therapeutic work.

Lower motor neuron lesions are characterized by flaccid paralysis of involved muscles, the muscles showing partial or complete reaction of degeneration. The pathological changes underlying such a paralysis will determine whether electrical stimulation of muscular contractions will be desirable or safe in the particular case at hand. The earlier stages of infantile paralysis contraindicate the use of any electrical stimulation. The rule is: No electrical stimulation in the presence of pain. When the acute period is over, smooth sinusoidal cur-

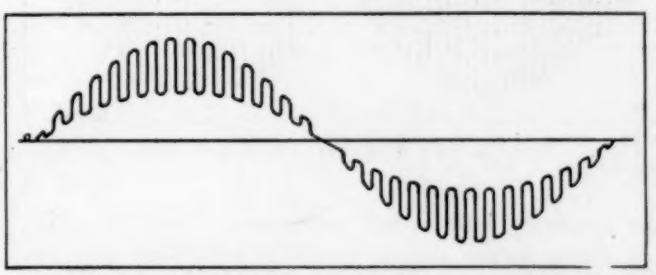

Fig. 6. Superimposed wave or riffled slow sinusoidal current. (Diagrammatic, does not show true frequency or superimposed wave, which should be 40 to 80 per second.)

rent may be applied cautiously to the paralyzed muscles, using the unipolar method. When R. D. is complete, the motor point is gone and the point of election is usually toward the distal tendon of insertion. The dispersal electrode may be placed at any convenient place, although dorsal surfaces tolerate electrical irritation better than ventral areas. Only a faint contraction is necessary, and three or four contractions may be all a muscle can tolerate without fatigue at first. Slowing of the period of relaxation is the first danger signal of fatigue, later the period of contraction slows, and lastly the contractions become writhing and worm-like in character. Stimulation must stop at the first sign of fatigue. The technician should insist on maintenance of the position of physiological rest at all times, whether the brace is removed or not. Muscles need not be required to perform work while under treatment in order to profit by sinusoidal stimulation.

Most workers in this field recommend heat in some form to precede massage and sinusoidal treatment. Radiant heat is easily applied and of sufficient penetration, and its use will improve the conductivity of the skin, soften the muscles and increase the blood supply to the parts. Massage is unnecessary or even harmful in the earlier stages of treatment, and may add to the fatigue of an already tired muscle. Later on, light strok-

ing massage is indicated, though here again there is danger of overdoing manipulation following the application of the sinusoidal current. The tendency is to manipulate these wasted parts too much and massage can be as dangerous as electricity if used wrongly or with too much enthusiasm.

The muscular contractions induced by careful use of smooth sinusoidal currents bring about an improvement of local circulation and lymphatic drainage, conserve muscular tonus as long as possible, and maintain muscular irritability. We attempt to postpone as long as is humanly possible the advent of complete atrophy; to conserve the muscle tissue in as nearly a normal state as may be in order that regeneration of nerve may be fostered and that the first flicker of volitional control may be detected. It is surprising to note how early a voluntary twitch may appear when the integrity of the muscular tissues is preserved thus. There is no question that many muscles have received a partial return of nerve supply, only to continue to atrophy because of long immobilization and failure of some competent observer to note the faint voluntary response and foster its return. When a muscle has become a fibrous mass it is too late to do more than ankylosis of joints, to cobble

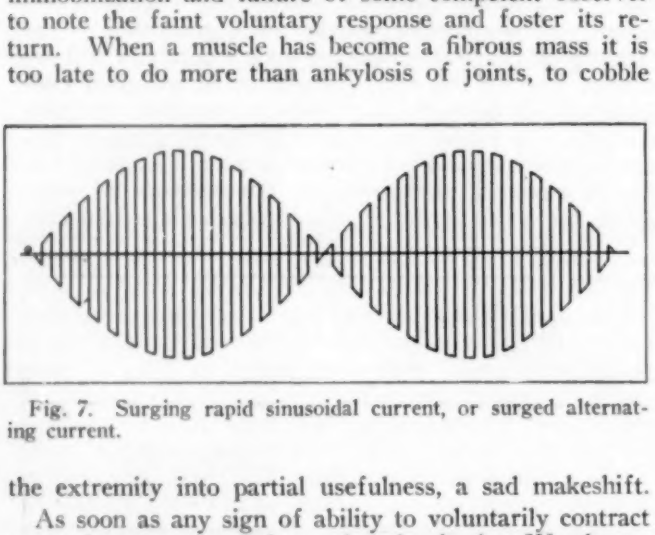

Fig. 7. Surging rapid sinusoidal current, or surged alternating current.

the extremity into partial usefulness, a sad makeshift.

As soon as any sign of ability to voluntarily contract a muscle appears, muscle re-education begins. We change from a smooth sine wave to one which is roughened or interrupted at greater frequencies, such as the riffled slow sine or a pulsating rapid sine. The latter is an alternating current which is varied by a cam mechanism so that the succeeding cycles increase in intensity from a low value to a higher one gradually, the peak being succeeded by a similar gradual decrease in potential to almost zero again. (Fig. 7.) The contractions induced may be increased in extent as recovery takes place, and the number of contractions are also increased in number at each sitting, always within the limits of fatigue.

The advantages of a sinusoidal current over the old interrupted Galvanic shocks are appreciated by those who have had opportunity to employ both methods. Interrupted Galvanic stimulation of a muscle gives a single quick jerk of muscular contraction, far removed from the smooth shortening and elongation of volitional movement. Such jerky responses are unpleasant to the patient, difficult to control, and are not physiological or normal. They are dangerous to the continuity of weak, flaccid, paralyzed muscle, and the damage which may be done is great. It is not surprising that, with such injuries in mind, neurologists and orthopedic surgeons are prejudiced against electrical stimulation of paralyzed muscles. Faradic electricity is ineffective in the presence of complete R. D., and is dangerous to use upon muscles which are recovering from flaccid paralysis. The impulses do not come regularly, they are often too rapid for the slowed chronaxie time of the injured muscles, and hence must be increased in intensity, with the result that the weak muscles are thrown into complete tetany. This will rapidly over-fatigue them, releasing toxins and excess sarco-lactic acid into the muscle substance which will damage the muscle fibers and slow up the process of recovery or even stop it. It is not surprising that many physicians say never to use electricity in infantile paralysis when they observe such harm done in cases which otherwise might recover sooner by being let alone. Electricity in any form used to the exclusion of proper physiological rest and other recognized measures is both ignorant and vicious.

The technic of application of sinusoidal currents has been described so well and in such detail that little need be added. When R. D. is complete the active electrode is placed at the point of election which is toward the distal end of the muscle belly, and we thus take advantage of the longitudinal reaction of Doumer-Huet. When spread of current to normal opponents is troublesome it is sometimes necessary to use a bi-polar application, with a small muscle electrode at each end of the muscle. Less current is usually required with bi-polar technic. Checks of progress in treatment should be made at frequent intervals with both interrupted Galvanism for polarity changes and with Faradic for detection of regeneration.

The principles suggested for poliomyelitis are in general applicable to the treatment of all lower motor neuron lesions. Erb's paralysis and paralysis following nerve wounds improve very well under sinusoidal stimulation, provided nerve suture can be done, or provided the injury does not involve the entire nerve trunk. The paralysis of late polyneuritis also yields readily to such management, and the use of these currents in Bell's palsy is so well known as to need no comment, since the results are excellent in a surprisingly large percentage of cases. The physiological rationale of sinusoidal currents will suggest to thinking workers many excellent uses for these new agencies.

Spastic cases are alike in showing no reaction of degeneration. The muscles affected are hypertonic, they fibrillate, and are ready to contract at the slightest stimulus. The use of any form of electricity seems to welcome defeat. But sinusoidal currents have been used with good results in selected cases, as adjuncts to the routine re-education and muscle training. Osborne says, "The object of treatment is to treat the opponents of the spastic muscles so as to minimize contracture, the effects of over-stretching the normal muscles, and to maintain their tone and nutrition." This is in contrast to the ideas of Mennell,[9] who states, "In a spastic case you do not want to exercise the muscle, but simply to show the muscles how to relax and contract. The simplest way to teach them to relax is to contract them with Faradism, and to relax the moment Faradism ceases."

Electrical stimuli can not be applied in any case until the confidence of the patient is gained. The first attempts are toward relaxation, assistive movements, recoordination and rhythmic movements of the affected parts. Needless to say, a certain minimum standard of mentality must be met for spastic cases before any re-education can be attempted. The first three or four treatments should be confined to heat, massage, and assistive or passive movements. Proper braces or other appliances are placed by the surgeon to minimize the contractures due to spastic groups and to hold the ground gained in treatments. Rhythm is the secret of re-education of the spastic child, as proven by the able work of Miss Mary Trainor of Boston. Any aid we may give in forming new association pathways and in teaching the child to use his muscles in a normal way is of value.

The slow, regular contractions induced by the sine current, preferably the slow riffled or the slow swell wave of the rapid sine, aid by causing even, rhythmic contractions of the involved parts. The patient is shown that those muscles are capable of carrying through a normal sequence of movement. Only a very small amount of current is used at first, applied at the fourth or fifth sitting. The time and intensity are increased as the patient gains tolerance to the current. In this country the tendency is to apply the current to the normal opponents of the spastic muscles rather than to make spastic muscles relax following stimulation. Also the use of sine currents instead of Faradism is increasing, because they are more effective with less intensities and are capable of causing a smooth contraction and relaxation, in contrast to the tetanic plateau response to Faradism. There are cases in which all thought of any electrical treatment must be abandoned because of the extreme hypertonicity and spasms which even a tap on the muscles will cause.

The application is over the motor points in the spastic case, with a large dispersal electrode upon an indifferent point. Five to ten contractions per minute are enough and treatments may be prolonged as desired, since fatigue is a minor factor. Treatments are continued only long enough to ascertain whether the underlying pathological changes can be removed or improved or better function secured. Sinusoidal currents are merely adjuncts to the re-education of muscles in spastic paralyses. Any resource which may aid in the long task of training a spastic patient to use his muscles should be welcomed, and patience and time are the two essentials to success.

CONCLUSIONS

Sinusoidal currents are new in the field of physical therapy.

The nomenclature is not stabilized, and much misunderstanding has arisen because of failure to specify the exact types of current meant in papers on the subject. The chief types of sinusoidal currents are described.

Much physiological knowledge is available upon which to base a rational use of electrical currents, though the profession has been slow in accepting facts regarding electrical stimulation of muscles in the treatment of disease.

Sinusoidal currents are of definite value in the treatment of paralysis of lower motor neuron type, and they are of assistance in the re-education of patients with spastic paralyses.

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Restoring Function to Muscles, Joints and Bones

(From the Physiological Standpoint)

Halbert W. Chappel, A. M., M. D.

Read before the eighth annual convention of the American Physiotherapy Association, Portland, Ore.

The success of the physiotherapist in restoring function, partially or completely, is proportional to the direct application of physiological processes.

Following disease, sprains, strains, simple or compound fractures near or into the joint, dislocation, or rupture of periarticular tissues, there are varying degrees of stiffness. This limitation of motion is due to an inflammatory reaction in or about the joint. Strong bands of fibrous tissue form in the lacerated or diseased tissue as the result of the effusion of blood and serum, or by prolonging rest until the obstructive bands matured, or by adding injury, by too early passive movement, to the existing active state of repair.

Neuromuscular spasm is the constant protection of the injured or inflamed joint until a complete painless range of motion has been restored. Its presence is the chief contraindication to passive movement.

Normal muscle is contracted or relaxed by volition. These are two opposite physiological states, so that no muscle can be in a state of physiologic contraction at the same time that it is physiologically relaxed, as the voluntary stimulus which causes contraction of one group of muscles also causes relaxation of its opponent. The action of the latter should be thoroughly understood before the former is treated. Then the antagonist can be taught not only to relax but to limit its action, thus leaving the weakened muscle free to act, as soon as it has power to do so. This power can not be regained as long as the muscle is subjected to a strain, or is in any way deprived of its full opportunity for movement.

Therefore, it is by a proper combination of rest and muscle action that a joint recovers its normal range of motion. Rest for the elongated muscle means stretching for its contracted opponent. As definite structural changes have taken place in both muscles, the lengthening of the contracted muscle should be simultaneous with the shortening of its stretched opponent, so that there will be a restoration of normal tone of the opposing groups, when the affected muscles have completely recovered.

The joint exists for the muscle, and the only way in which its motion may be obtained is through a neuromuscular mechanism which controls voluntary movements, so that the one thing essential to recovery is voluntary effort on the part of the patient. It is of utmost importance to impress on him clearly the fact that his recovery depends entirely upon his own persistent and accurate effort.

Purely voluntary movements rarely allow a range sufficient to cause pain. It is not a greater range of motion attempted passively that causes pain and a more limited movement, but the neuromuscular spasm, over which the patient has no control, that results from any effort to handle the joint beyond a very limited range.

Relaxation and improved circulation of the disabled muscles and joints, by heat and massage, are most desirable before attempting active movements. It is well known that variations in temperature affect both the extent and the variation of muscular contraction. As the temperature of a muscle is raised, a given stimulus causes proportionally greater contractions, so that maximum activity may finally be obtained without increasing the effort. There is also an increase in the amount of blood in the heated muscles and a corresponding change in the rate of blood flow.

Heat is the most frequently used of the physical therapeutic agents. Its definite action is not known, that is, we have not been able to definitely ascertain the depth to which it will penetrate in the living tissue, and its effect on that tissue.

The soothing effect of heat is well known, and probably that is the reason it has been so generally used. Heat alone is very damaging to swollen and congested tissue, because it causes greater hyperaemia, resulting in increased stasis, greater stiffness, and more pain. The kind of heat makes no difference, and I am a firm believer that the color of the light has but a psychical effect. The strength of the heat and the time of its application are the chief therapeutic factors and must be most carefully determined for each case. Always follow the heat immediately by massage, most carefully given, until the circulation has been completely changed. Then the damaged tissue is in the best possible physiological condition to respond to voluntary stimuli, which is by far the most valuable of our therapeutic agents.

As there is in many cases practically an entire forgetfulness of the co-ordinating path and muscle and joint sense, it becomes necessary to begin with the slightest voluntary movement, and re-educate all muscles controlling the disabled joint.

Encouragement is the greatest stimulant to maximum effort in restoring function to a diseased or traumatic joint. This may best be obtained by appliances that accurately record every movement, which is graphically charted and kept under constant observation by the patient. No other stimulus causes so powerful a reaction as that of persuading the patient that he could at least make as great an improvement as he did the preceding day.

Swelling, which always limits motion and retards progress, may be kept under control, or even prevented, by elevating the damaged muscle or joint to nearly a vertical position. The application of this physiological principle enables gravity to be of greatest assistance to the venous and lymph currents. The ice pack, constant at first, then intermittent, has also helped greatly to bring the swelling under control. Another aid is gentle pressure, by means of felt pads, and adhesive plaster, or broad flannel bandages.

Physiological rest is very necessary and this must be rigidly observed. Complete relaxation between each exercise and frequently changing the exercises from one group of muscles to another, insure sufficient rest to maintain muscle tone. When the movements have produced pain, the slightest fatigue, or a lessened range of motion, additional damage has been done to the tissues and must be repaired by rest before further progress is possible. This may be accomplished by the use of splints, a sling, crutches, appliances or by absolutely discontinuing all active and passive efforts for several days.

In order to obtain a maximum result with a minimum amount of effort and in the shortest possible time, there must be the absolute cooperation of the patient both and persistent efforts between treatments. The physiotherapy department should have a well-equipped gymnasium which should be the most important part of its treatment. Any piece of apparatus necessary for the case being treated may be easily and cheaply duplicated for home work. I insist from the very beginning that the gymnasium is only for instruction, correction of movements wrongly done, and measuring progress which may be accomplished only by the most accurate and persistent efforts between treatments. The physiotherapist should be able to determine, as readily as the teacher of music, to what extent the patient practiced the exercises given during the preceding treatments, because function returns in direct proportion to voluntary effort.

The application of heat and the use of massage should not be a part of the home treatment. However, an exception to that is the use of contrast baths. Because they can be given so efficiently at home, I believe they may be omitted in the treatment room. Ice should be kept in the cold bath and the hot bath kept to the tolerance of the patient, so that "arterial gymnastics," in the words of Sir Robert Jones, will really be the result of the treatment.

Morale, which registers the patient's attitude toward recovery and his willingness to cooperate, must be brought to a high level as soon as possible and kept there until the per cent of improvement has been obtained. A truly great helper in the field of physiotherapy is the determination of the patient to recover his lost function, because it furnishes the repeated natural stimulus for repair of the damaged tissues and increase in movement of the disabled joints.

The interest of the patient must be kept up continually by carefully selecting a variety of competitive as well as graduated exercises. Any deviation from the formal exercises stimulates new interest and hastens progress. Hammering nails, putting screws into and taking them out of soft wood, weaving baskets, splicing rope, and sewing with long thread, are some of the accurate means of registering speed, increasing the range of motion, and restoring strength to the disabled muscles. Greater effort may often be stimulated by the use of the punching bag, medicine ball, swimming, golf and tennis. Therefore, by the constant use of the mind-muscle pathway, progress in the restoration of function may be recorded each day.

Treatment for Injured Hands

After heat and massage, patients are expected to exercise in the workshop.

Picking up objects—Soft towels, checkers and beans of various sizes. Normal—60 small beans per minute.

Hammering nails—Graduated by using hammers of various weights, nails of different sizes and soft and hard wood. Normal—16-20 nails per minute, size 1¼ inch, in soft wood.

Screwing—Hard test—pressure on palm of hand—pronation and supination—quick motion of fingers. Normal—2-3 screws in one minute, size 1¼ inch, in soft wood.

Pumping water—From one level to another by means of squeezing a bulb. Gives a good estimate of patient's strength and ability. Normal—1000 cc. in one half minute.

Sandpapering—Using sand blocks of various sizes.

Cutting—Graduated from scissors and paper to cardboard and shears.

Pumping Air—Using hand pump to inflate tire or punch bag.

Spading—The hand action is quite different in shoveling coal and digging.

Sand Box—We have constructed a large sand box where patients can practice the actual movements that they have to carry out at work—spading, raking, filling pails with a trowel, carrying pails filled to various weights, etc.

Bricklaying—The patients can actually practice building a wall with bricks, using wet sand for mortar.

Assembling Motors—Assembling and taking a motor apart requires the use of a number of different wrenches, pliers and other tools.

Painting—A painter must have good flexion and extension of wrist. He can practice on a blackboard, using water for paint.

Winding Armatures—A difficult but good finger exercise.

Games create competition and relaxation. Patients are then working at their highest capacity. Bouncing and catching a ball gives pronation and supination. Catching a ball with elbow flexed and palm out gives flexion of fingers, etc.

We believe that heat and massage will relieve pain and get joints in the best condition for exercise but that there is only one person in the world who can re-educate muscles and that is the patient himself. He controls the switchboard that operates his muscles. We can only teach, direct and guide him so that his efforts bring the best functional results.

Patients receive a hot wax treatment when they have completed their exercise.

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A Minimum Standard for a Physical Therapy Department of a General Hospital

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A hospital to be recognized as modern must be so equipped that the sick may benefit by the latest discoveries in the scientific methods of cure. Among the scientific developments of the past few years, physical agents have taken their place among the effective curative methods. Therefore every hospital needs some physical therapy. In considering the subject we should remember the advice of Pope:

"Be not the first by whom the new is tried,
Nor yet the last to lay the old aside."

LOCATION AND SPACE

No standards can be set as to the location and the space required for this department as these vary not only according to the number of patients but also to the class of cases treated in the hospital. For instance, the Pasadena Hospital has a complete new building for physical therapy, with a separate street entrance and a direct connection with the main hospital building. There are separate departments for men and women, and a complete hydrotherapy department. Where there are a large number of neurological cases a plan such as is used in the Grace Hospital of New Haven, Connecticut, could be used.

One practical rule in regard to location can be definitely stated, i. e., as light and exercise are important physical means of treatment, this department should be placed where it can be well lighted and have good ventilation. If possible, a part of the roof and the southern wall should be fitted with a window glass substitute that will transmit ultraviolet radiation.

In a new hospital this department should be located so patients can be conveniently brought to it from the wards or their rooms; so that outpatients do not have to travel through the hospital corridors, and so that apparatus can be conveniently moved to the operating room or to patients' beds. Such a plan has been worked out satisfactorily by the Passavant Hospital, Chicago.

In a hospital already built, available space must be utilized. With steel partitions seven feet high one large room can be divided into smaller rooms or cubicles in a convenient manner. In one hospital a room 30 x 24 feet was divided in this way into seven smaller rooms, giving a room for massage and therapeutic exercise, a room for ultraviolet radiation, three rooms for massage, heat, diathermy and sinusoidal, a room for whirlpool baths, and a room for surgical dressing, surgical diathermy and office.

In county hospitals or in hospitals treating only industrial cases a large room may be divided into cubicles by means of wires stretched from wall to wall, seven feet from the floor, from which sheets 6 feet long are suspended by hook safety pins.

In either of these types of construction one technician can keep three cases under treatment at one time, if they are properly arranged.

The floor covering should be soft, as the technicians are on their feet constantly and a hard concrete floor will soon cause foot strain, thus lowering their efficiency; and, if damp, will act as a ground for the electric current. Linoleum, or a rubber composition, is the most efficient. A concrete or tile floor should be used for the whirlpool bath room.

For the electric current it is a great advantage to have outlets placed in pairs so that direct and alternating currents are available at all places. The connecting plugs for alternating current and direct current should so differ that it will be impossible to connect an apparatus to the wrong supply current. It is important to have at least one set of outlets in each treatment room. Where only direct current is available, polarity plugs should be used. There should be a call system which may be used by the patient if he should be uncomfortable during the time of treatment.

The department should have or be near a toilet. There should be sufficient closet space for linen and blankets.

EQUIPMENT

No standard list of equipment can be given, for much scientific research in biophysics must be completed before the value of various instruments can be stated. For instance, ultraviolet lamps are of two kinds, carbon arc and the mercury quartz. The carbon arcs are of two classes, high and low amperages. The manufacturers of these lights make various claims for the carbon arc lights. (The two things usually stressed are: first, that some of them are non-burning, which simply means that they have cut out the short ultraviolet rays, and this in our experience is a disadvantage, as erythema and pigmentation are often desired advantages; and second, they claim superiority over the mercury quartz lights as theirs have a continuous spectrum while the others have a gap spectrum, but this has not proven detrimental in the use of the mercury quartz lights.) While the high amperage carbon arc lights are being used in some institutions for treating groups of patients, such as tuberculosis hospitals, the low amperage lights have not as yet proven their value, except for local treatments.

Expensive appliances make a fine showing and produce a great impression upon the patient, but it is to be remembered that the value of the service rendered by a physical therapy department is dependent upon the knowledge of its personnel.

The instruments should be of standard make and purchased from reliable manufacturers who are prepared to furnish good service in repairs and in replacing broken parts. This is most important, especially if the department is small and there are only a few machines of each type.

Different classes of cases require such different equipment that the list given here will be for a general hospital only. For instance, in a chilren's hospital there will be a great need for ultraviolet lamps, with

practically no need for high frequency machines, as it is practically impossible to give diathermy to small children. Here also will be needed apparatus for corrective exercises and an occupational therapy department. In tuberculosis hospitals the need will be for ultraviolet lights and solaria, with practically no need for sinusoidal machines or corrective exercise apparatus.

SUGGESTED EQUIPMENT LIST FOR A PHYSICAL THERAPY DEPARTMENT OF A GENERAL HOSPITAL

MASSAGE, MUSCLE TRAINING AND THERAPEUTIC EXERCISE

4 Treatment Tables with Pads
1 Mirror on Stand for Posture Training
1 Wheel for Shoulder Exercise
1 Sayre Head Sling
1 Wrist Cone
2 Pr. Light Dumb Bells
1 Ankle Exercise
1 Stall Bar
1 Elbow Exercise
1 Shoulder Abduction Ladder
1 Rowing Machine
1 Foot Inversion Tread
1 Table for Hand Exercise (complete)
1 Pronation and Supination Exerciser
Approximate Cost $294.00

ULTRAVIOLET RADIATION

1 Ultraviolet Radiation Combination Quartz Lamp Outfit
1 Adapter
1 Prism Applicator, Medium
1 ½-inch Localizer
1 ¾-inch Localizer
1 1-inch Localizer
1 Adjustable Holder
1 Quartz Pencil Applicator, 2¾ x ⅛ inches
1 Quartz Rod, 2¾ x ¼ inches
1 Quartz Nasal Applicator
1 Quartz Pharyngeal Applicator
Approximate Cost $1234.00

FOR HIGH FREQUENCY, GALVANIC AND SINUSOIDAL CURRENTS

1 Galvanic and Sinusoidal Machine
1 Mobile Cabinet Stand for above
2 High Frequency Machines
2 Mobile Cabinet Stands for above
2 Lamps on Floor Stand
2 1500 Watt Bulbs for above
1 Electro-Diagnostic Set
3 Metal Handle Electrodes
2 Spongio-Pilene Electrodes, Rubber Insulated, 3-inch
2 Spongio-Pilene Disc Electrodes with Stud, 1½-inch Dia.
2 Dispersive Electrodes, 4 x 6 inches
1 Dispersive Electrode 6 x 8 inches
1 Dispersive Electrode, 10 x 12 inches
2 Pr. 8-Foot Electrode Cords
2 Threaded Adapters
2 Multiple Cord Connectors, Insulated
2 Universal Handles only
2 Interval Timers
4 Pure Gum-Rubber Bandages, 3 inches x 3 yds.
5 Lbs. Electrode Foil
6 Electrode Clip Connectors
1 Complete Set Aluminum Needles with Handle
1 Large Metal Handle Electrode
1 Attachment Cord with Threaded Connection
2 Bifurcated High Frequency Cords
1 Auto-Condensation Couch Cushion
Approximate Cost $1850.00

WHIRLPOOL BATH ROOM

1 Leg Whirlpool Bath
1 Arm Whirlpool Bath with Stand
Approximate Cost $150.00

The electric apparatus given above is for alternating current and there is a difference in price for direct current installations.

The steel partitions to divide the space 30 x 24 feet into seven rooms will cost approximately $400.00.

The above equipment and space will enable one technician to treat sixteen to twenty patients a day, and for two technicians to treat as high as fifty patients a day.

RECORDS

A suggested plan is given here which may be altered to suit local conditions.

1. *Treatment Record Sheets* to correspond in size to the other hospital history sheets. This is made out in duplicate, one for the file with the hospital record and one for the physical therapy department file.

The referring doctor or his interne writes the patient's name, ward or room number, the diagnosis and X ray findings, and states what he wishes to accomplish or the suggested treatment.

The director of the physical therapy department inscribes the physical therapy prescription, the number of treatments weekly and the progress.

When the case has reached its maximum improvement the case is sent back to the referring doctor who makes the final findings and notes the results.

2. *Patient's Card* will correspond to the outpatient's card for other departments. This will show the time of appointment and the amount paid for treatments.

3. *Record Book* of the department should be arranged to give the following data for a report:

Number of individual patients
Total number of serial entries
Total number of treatments
Average number of days per patient
Average number of treatments per patient
Total treatments and treatments of each class.

4. *Diagnosis Card* filed under diagnosis to correspond to the diagnosis system used by the hospital. This card gives the diagnosis at the top and contains a list of the patients' names, hospital numbers, treatments and results.

PERSONNEL

In these days of high-powered salesmen for all sorts of machinery for physical therapy, who talk of the large profits to be derived from this department, it would seem that the only requirement for this department would be a diathermy machine or a lamp. The idea of selling machines by emphasizing the importance of machinery in physical therapy and giving the impression that this department needs only apparatus and someone of ordinary intelligence to run it, but offering to train technicians by a week's course, is doing much to bring the whole subject into disrepute with patients, hospital authorities and the medical profession.

To train a technician for a physical therapy department in a week's course is not only poor judgment on the part of the manufacturers of physical therapy equipment who do this, but is as bad as trying to train for a nurse or a pharmacist in such a period. It is be-

lieved, however, that manufacturers can do an excellent service by giving a course of one week in operative technic to those who have had a previous proper training. You would not think of buying good drugs for your pharmacy and putting in a person with a week's training in pharmacy to fill the prescriptions, yet this is just what is happening in many hospitals today in their physical therapy departments.

A week's course in operative technic will equip any person of normal intelligence to run a machine, and we believe that a person with a high school education can be trained in a week to be an electrotherapeutic technician. The only difficulty with this condition is just this—physical therapy is not machine therapy. Hospitals who have gone into physical therapy with the idea of only machine therapy will come out of it with a bitter feeling toward the whole subject and their machines will soon be covered with dust, as many of the hospitals have found who bought static machines and Zander exercise apparatus years ago.

Therefore, a most essential requirement for a physical therapy department is a properly trained personnel. It is believed that this department should have a physician to supervise it. It is realized that few hospitals can pay a salary for this, and that it is hard to get any person to do good work for nothing. One criticism that is being aimed at physical therapy departments is that patients are kept there too long and that some are being unnecessarily treated. This is especially true of industrial cases where the patient is drawing compensation and is perfectly willing to come indefinitely for treatment. It is not believed that decisions on the length of treatment and the kind of treatment can properly be left to the technician. But a physician should see the new cases to prescribe the treatment, which has been suggested possibly by the referring doctor; see each case every two weeks to decide if the maximum improvement has been reached or if the treatment needs changing; and to see cases at other times as the technicians request.

The compensation for this physician may be on a salary basis or, as one hospital proposes, as follows:

The physician is to be given the net profit. The expenses of the department will include equipment, depreciation, interest on investment, rent for space, salaries, supplies, etc. In this way, the hospital will neither make nor lose money. The physician is to receive the net profit until such time as he has received an amount equal to that which the hospital has taken for expenses; then the hospital is to receive ten per cent and the physician ninety per cent of the net profit, until such time as the net profit becomes ten thousand dollars; from ten to fifteen thousand dollars, the physician to receive eighty-five per cent, the hospital fifteen per cent, and so on. This keeps the hospital out of competitive medicine, keeps the physician interested in keeping down the expenses of operating the department and gives him practically all the profit.

The treatments should be administered by properly trained technicians, who have had some instruction in medical ethics. It seems hardly possible that the medical profession and the hospital authorities are less critical of the requirements for this work than the people who actually do the work under their direction. But this is so, when we consider the requirements of the American Physiotherapy Association, an organization of physical therapy technicians. Their requirements for full membership in their association are surely not too high for the hospitals to set as a minimum standard for the technician in charge of administering physical therapy in their departments. They require a high school education, completion of a course in a recognized physical education school or in a recognized training school for nurses, the completion of a course in a recognized school of physical therapy, and to have had one year's experience in this work within two years following graduation. This association maintains a free service bureau to supply such technicians. This bureau is under the direction of Miss Grace Courter, Garfield Memorial Hospital, Washington, D. C.

It is evident that many small hospitals are not in a position to pay the high salary necessary for a person with this highly specialized training. To meet this situation, it is suggested that groups of small hospitals in the same localities arrange for the services of one supervising physiotherapy technician to divide her time among the hospitals. The routine work, such as ultraviolet radiation and diathermy treatments, may be performed by one of less experience. This arrangement will prove advantageous to the hospital, as the staff will support a department with a highly trained technician.

Why all this emphasis on properly trained personnel as a most essential requirement for a physical therapy department? Because an important part of physical therapy is proper massage, therapeutic and corrective exercises and muscle re-education, necessary in the treatment of the majority of the cases from the surgical and orthopedic departments, such as fractures, nerve injuries, infantile paralysis and spastic paralysis cases, and no machines have been invented to do this work.

CONCLUSIONS

Only suggestions can be given as to the location, space, records and equipment needed for a physical therapy department; but certainly a minimum standard for a hospital physical therapy department is that it be under the charge of a physician and that treatments be administered by properly trained personnel.

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Merger of Acme-International X-Ray Company and Engeln Electric Company

The merger of the Acme-International X-Ray Company of Chicago and the Engeln Electric Co. of Cleveland, to be known as the American X-Ray Corporation, has just been announced, effective July 1, 1929. Both of these companies have for many years played a conspicuous role in the development of X-Ray and physical therapy apparatus, and have won a vast number of friends in the medical profession throughout the country.

The extensive lines of both companies will be retained essentially unchanged, and a wide distributing organization, covering the United States and many foreign countries, will be maintained to service the products and give the closest personal attention to the requirements of the medical profession.

This concentration, bringing together greatly increased facilities for production, research, experimental and educational activities, should prove of striking benefit to the profession, which is now offered an exceptionally wide line from which to choose suitable equipment, and if assured of excellent service facilities in any part of the country.

Leonard A. Busby, president of the Chicago City Railways, was elected president of the American X-Ray Corporation, a very good index of the financial strength and the sound business policies which characterize this new organization. The officials who have in the past guided the two companies to a position of leadership in the industry remain actively in charge of its management: H. P. Engeln, first vice-president in charge of sales; Frank L. Severance, vice-president and general manager; and Montford Morrison, vice-president and chief engineer.

Physiotherapy as It Is Applied in England in the After Treatment of Dislocation of the Internal Semilunar Cartilage

Mary V. Flannery, C. S. M. M. G., M. E.

The stability of the knee joint is mainly dependent on its muscles, ligaments and cartilages, hence, any injury to these tissues will naturally interfere with the function of the joint.

Of the two semilunar cartilages, the internal, by reason of its shape, location and attachment, is more prone to injury. Among ice skaters, foot ball and hockey players and in certain industries, notably coal mining, this condition is particularly common. It is caused by a sudden strain upon the abducted and slightly flexed knee while the foot is fixed in the everted position. As a result the internal lateral ligament is subjected to considerable tension, and by reason of its attachment to the internal semilunar cartilage, the latter is pulled through the partially open joint. In the act of falling, the tension on the knee is released, and the joint closes. During this process the cartilage may attempt a return to its normal position or a part of it may get nipped between the margins of the joint surfaces.

Disregarding the severity of the injury it is absolutely necesssary that the dislocation be completely reduced. Having fully extended the knee, the surgeon firmly bandages it on a posterior splint and there is usually found a reduction of swelling after a few days rest. Physiotherapy is then ordered. Should the dislocation be recurrent removal of the cartilage is then the only treatment advisable. When the non-operative method is indicated the aims of treatment are as follows:

(1) To rest the damaged structures and to assist in their repair.

(2) To hasten the absorption of any exudate in the region of the joint.

(3) To restore the tone of the muscles and ligaments involved in the function of the joint.

(4) To teach the patient to walk in the corrected position. At this state of the treatment physiotherapy is most beneficial. Warm whirlpool baths and radiant heat obtain a local hyperemia and also produce a soothing effect on the injured structures, thereby reducing pain and discomfort.

1st-4th day: Effleurage and careful kneadings to the thigh and lower leg. Frictions to the ankle joint. Passive movements to the patella. (Direction side to side, upwards and downwards.)

5th-7th day: Effleurage and kneading to the whole leg. Deep kneadings and tapotement to the quadriceps. Passive movements to the patella. Active contraction of the quadriceps. Passive and active movements of the ankle and toes.

10th-11th day: Active flexion and extension of the knee joint may be added, the operator supporting the weight of the limb while the patient performs each movement.

Then, as progress continues, the patient is encouraged to bend his knee over the side of the bed, the force of gravity assisting in the performance of the movement. In order that gravity will aid extension, the patient lies in the prone position, and then extends his knee. Usually at this stage the muscles are still flabby from disuse; if desired, Faradic stimulation may be carefully given.

With the return of normal function the splint is discarded and the necessary support for the joint is a firm bandage. To prevent any strain being put on the internal lateral ligament a little pad is placed over its points of attachment, and when applying the bandage care must be taken that it serves to keep the joint in the corrected position. It is obvious that any tension on the inner side might easily result in a recurrent dislocation. To prevent such an occurrence, Sir Robert Jones advises that the heel and sole on the inner side be made 1/3" higher than on the outer side.

In operative cases massage is begun on removal of the stitches. During the treatment a sterile dressing is kept on the incision. As soon as possible it is advisable to give careful frictions round the wound so as to prevent the scar from becoming adherent to the underlying structures. Otherwise, the outline of treatment is the same as that given for non-operative cases.

Home exercises are a very important feature in the later stages of treatment of dislocated internal semilunar cartilage. When the patient can be depended upon to carry out the doctor's instructions at home, and to attend the physiotherapy department regularly, there is no need to prolong his stay in hospital.

The following scheme of exercises is quickly learned by the patient and may be performed by him without supervision.

(1) Long sitting active contractions of quadriceps.
(2) Sitting knee flexion and extension.
(3) Walking on tip-toe with stiff knees.
(4) Fall-out standing knee flexion and extension.
(5) Reach grasp standing heel raising and knee bending.
(6) Cock step walking.

The following precautions should be observed during all treatments.

(1) The appearance of any signs of inflammation should be reported immediately to the surgeon in charge.

(2) Splints should be well padded and bandages should be correctly applied.

(3) When active movements can be performed the joint should be put through its full range so that one movement is not gained at the expense of another.

(4) Outward rotation must be avoided.

(5) In operative cases care of the incision is essential.

The popularity that this method of treatment has gained in England is due to the fact that it has hastened the progress of complete recovery in such a large percentage of cases. In consequence patients have been enabled to resume their original occupation. When this has been achieved by any form of therapeutics, in my opinion, the acme of success has been reached, because return of function is best measured in foot-pound units.

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Body Mechanics

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Read before the Eighth Annual Convention of the American Physiotherapy Association

I. INTRODUCTION

Body mechanics, as we now accept the term, is but a small part of the wider study of animal mechanics. The new term is reported by Stafford (1a) to have been first used in the classification of entering Harvard freshmen in 1916. It is more satisfactory than the limited term "posture," with its rather unfortunate emotional attachments of exaction and discomfort, or of "poise," which has both aesthetic and mental associations.

Mechanics is defined in the Concise Oxford Dictionary as a "branch of applied mathematics treating of motion and tendencies to motion." Although we do not occupy ourselves consciously with applied mathematics, nevertheless we are dealing with masses to be held or moved by muscles according to the laws of motion and leverage, with regard to the composition and resolution of forces, which are properly parts of the field of mechanics. The study and use of mechanics applied to the problems of position and motion of the human body or its parts is no small portion of the business of the physical therapist. I shall attempt to state certain of these applications as they have become clear to me through my own study and experiment.

Before attempting to analyze the mechanical situation in the normal human being, I shall briefly review certain recent studies which have made distinct contributions to our knowledge and have led to improvement in our practice.

Dr. R. W. Lovett of Boston (2a) made a study of the motions of the human spine, and reached conclusions which are now probably part of every physical therapist's information on this subject (2b). These conclusions were soon carried over into effective exercises for mobilizing and improving the position of the spine by Dr. Klapp and Dr. Fraenkel of Berlin, and used in the orthopedic outpatient department of the former Royal and Imperial Hospital in Berlin.

Dr. H. O. Feiss of Cleveland (3) studied the motions and tendencies to motion of the spine and thorax. His study and the action of his steel and leather models showed the effect of unilateral strain on the ribs, inducing or augmenting convex rotation of the spine. Rotation as a movement of the spine and thorax has been used in jacket technique (4) and in exercises (5) for scoliosis. Exercises of this type are described in Dr. Truslow's paper on the "Non-operative Treatment of Scoliosis" (5).

To Dr. J. E. Goldthwait of Boston (6) we are indebted for a realization of the importance of good body mechanics for the position and normal functions of the abdominal viscera. His studies in visceral and skeletal ptosis and the vigorous practical measures which he and his associates and assistants have devised for posture training and for improving muscular strength and control have contributed greatly to the prestige and effectiveness of such work all over the country.

To Dr. W. C. Mackenzie (7) we owe much for his studies in the comparative anatomy and function of muscles, and for the principles of muscle rest and muscular re-education from the zero position. From Dr. Mackenzie's conclusions on the essential function of individual muscles, it has been possible to devise exercises at once simple and effective for teaching certain controls necessary for the maintenance of mechanically good posture.

Dr. B. M. Mensendieck (8), a European teacher of wide and high reputation (now established in New York), through her studies in human kinesiology and their application especially to the needs of women, has devised exercises which, in my opinion, are unsurpassed, not only for developing admirable poise mechanically, but also for creating and releasing the aesthetic quality of grace.

One more instance, and this inadequate review is ended. Dr. C. L. Lowman of Los Angeles (9) through his sympathetic and far-sighted interest in the all-around development of children, his acquaintance with physical education procedures and his illuminating knowledge of growth tendencies, has contributed greatly, both in information and in practical ways, to insure the early detection and correction of unfavorable growth tendencies and toward the rectification of abnormalities of growth already present. Through Dr. Lowman, physical education teachers and physical therapists receive not only assistance in their practical problems but a helpful interpretation of the possibilities of their work to both medical and laymen. As Dr. Goldthwait awakened people in the eastern part of the country to the importance for physical welfare of good body mechanics, so Dr. Lowman in the west has emphasized the necessity and value of the cooperation of the physician, parents and trained teacher in securing the proper growth and development of children. Practical applications of his ideas may be studied in the work of Miss Roen at the Orthopedic Hospital School in Los Angeles, and in the book published last year by Dr. Lowman, Miss Colestock and Miss Cooper (9).

II. DESCRIPTION OF MECHANICALLY EFFICIENT POISE OF THE HUMAN BODY

Those who write on the subject of bodily poise and those who teach, as well, are brought to the necessity of defining or describing what it is they mean by "good" posture, or, as we now more carefully say, good body mechanics.

A chronological review of some of the more recent statements published in this country will present the tested conclusions of their authors, and will, perhaps, enable us to discover certain present trends in the development of our conception of good body mechanics.

We may begin with a description of Miss Bancroft's vertical line test (10). The vertical line test is a device for estimating the position of the long axes of the large segments of the body with reference to an imaginary line connecting the front of the ear and the fore part of the foot. The more nearly the long axes of the segments of the body approximate this line, the better the posture. This test is a simple and effective device for training the eye to recognize the relation in position existing between the segments of the body as well as the poise of the body as a whole.

Dr. Crampton (11) in his "Pedagogy of Physical Training" gives the following definition: "Good posture

is the best adjustment, first of the various body parts to each other; and second, of the body as a whole to its environment, task, or work."

Miss Lippitt in her "Manual of Corrective Gymnastics" (12) describes normal posture as follows: "The normal body is one which is held up at its full height, the weight upon the balls of the parallel feet, the head and chest well up, the shoulder blades flat upon the back, the costal angle from seventy to ninety degrees, the abdominal muscles strong, the abdomen flat at its lower part and fuller just below the ribs, the pelvis tilted at such an angle as to prevent an exaggerated lumbar curve, and the knees straight, but not stiff."

Miss L. C. Drew (13a) in the first edition of "Individual Gymnastics" gives the following "Analysis of Correct Posture": "For the term 'good posture' no absolutely definite standard can be given. It is the proper relationship between the parts of the body which corresponds to an ideal in the mind of each individual by which he almost instinctively recognizes 'good posture' as distinct from 'poor posture,' although oftentimes he does not live up to this ideal. Good posture indicates mental and physical poise. The body should be well balanced, in a position of ease, with the weight borne equally on both feet, the knees and hips entended, but not hyper-extended; the body should be held as tall as possible, without strain; the head erect and easily poised, with no tension in the neck; chest elevated; abdomen retracted; arms hanging easily from the shoulders."

In "Adapted Group Gymnastics," Miss Drew (13b) writes under "Exercises for Posture": "To assume good posture, stand on both feet with weight over arches. Draw body to full height, as tall as possible without strain; head erect. Draw in the waist. Allow arms to hang easily from shoulders."

Mr. G. T. Stafford (11b) in "Preventive and Corrective Physical Education" gives the following list of the characteristics of correct poise:

"1. The body is held as tall as possible without strain.

"2. The head is erect and the chin slightly drawn in.

"3. The shoulders are slightly posterior to the center of gravity.

"4. The chest is high.

"5. The abdomen is in (abdomen flat).

"6. The spinal curves are not exaggerated (gentle curves).

"7. The pelvis is tilted slightly upward in front and downward in back. (Fifty-five degrees.)

"8. The knees are straight but not stiff.

"9. The weight of the body falls just back of the middle of the foot on the longitudinal arches (between the two tarsal scaphoid bones).

"10. The body is free for movement without strain and with the least expenditure of energy.

"11. The entire body is in true anatomical position.

"12. The vital organs are free for most efficient function."

Lowman, Colestock and Cooper (9a) in "Corrective Physical Education for Groups" list the "Elements in Correct Standing Position" as follows: "Head up, chin in, neck back; abdomen flattened below; back with normal physiological curves; shoulders in correct relation to the gravity line; knees straight; feet toeing forward, one to two inches apart, weight on the outer border."

Miss L. C. Thomas (14) in the 1929 edition of "Body Mechanics and Health" writes of "Standing" (p. 40): "Good body mechanics means the correct poise and control of the body with the normal functioning of every organ. The correct position in standing or walking is with the head well back, chin in, the chest raised as if lifted forward-upward, the abdomen flat, and the weight borne about midway between the heel and the toes of the foot, a little in front of the upright (Fig. 2)."

Instead of comparing these statements in detail, it will be more profitable to select for discussion those elements which seem to me to be especially significant.

1. The approximation of the long axes of the segments of the body to a vertical line. This conception is in accord with mechanical principles, since segments superposed one precisely above the other are supported with the least instability and strain. Good body mechanics will require that the body in standing will be as closely assembled about a perpendicular as is possible.

2. The location of weight incidence on the feet. The point on the foot which should receive the brunt of the weight in standing is being shifted nearer the heel. We have noted instances in which it is recommended that the weight be borne "over the arches," "about midway between the heel and the toes of the foot," or "between the two tarsal scaphoid bones." It would seem to be in accord with sound mechanics to place the weight on the apex of the supporting arch, but so that it will be transmitted directly through bony structures to the ground.

3. The position of the pelvis. Since Dr. Goldthwait aroused attention to the importance of the position of the pelvis in maintaining a good mechanical position of the trunk, the amount of inclination of the pelvis and the means of controlling it have received much attention. Many of us realize that the pelvis may with advantage be held in standing less obliquely than has been thought. Now we find that our sense of the value of a decreased inclination of the pelvis is finding its way into the descriptions of good mechanical posture.

4. Recognition of the value of ease, or lack of unnecessary effort, in maintaining a desired position. An unfortunate element in much former training in body mechanics has been the unnecessary effort and the stiffness of the position that were encouraged, if not required. Weight has been inclined too far farward, the abdomen too much retracted, the chest too high, the neck too stiff. Breathing is hampered and fatigue comes quickly under such conditions. Small wonder that little "carry-over" rewarded conscientious teachers or industrious pupils. Nerves and muscles rebelled at unreasonable demands.

Miss Lippitt emphasizes "normality" (i. e., lack of elements of exaggeration) in posture, and Miss Drew, the value of ease, expressed by a lack of tension in the good posture.

In the recognition of the value which ease, or economy of effort, plays in position and in motion, we are shifting our conception of the "good" in posture from a mechanical toward an esthetic level. With ease comes grace, or "style," or "form." However we may name this element which a sensitive control of coordination adds to the purely mechanical advantages of the "good" (so-defined) in position and movement, we realize that it is a quality dependent on the former but differing from it, as its fragrance differs from the flower.

5. The suggestion of an objective value in the "goodness" of posture. To define the good posture as the best adjustment of the body to "its environment, task or work" (11) is to invite research in a wide field. One aspect of adjustment to environment, i. e., the welfare (mechanical efficiency or comfort) of the individual has been the subject of various problems presented to the technical committees of the American Posture League for several years past. Another, the adjustment in which the "good" is measured in terms of quantity of output, is the subject of studies in industrial efficiency.

In competitive athletics, especially, these two aspects of adjustment meet, since the conditions in the individual which make for mechanical efficiency contribute so greatly to the result in work accomplished.

As one works and studies, learning, experimenting, and revising, it is encouraging to find that some of one's hard-won conclusions and successes appear unexpectedly in the words or experiences of others, showing that the trend of our thinking, apart and independent as we may feel that we are, moves serenely along toward achievements perhaps inherent in the conditions and needs of our time. So that if some of the statements or devices that I shall use seem familiar to you, it will mean that we have reached the same stage in our development.

Let us consider the body as a contrivance for the manufacture and expenditure of energy. The manufacturing plant is inside the trunk; the directing organs are the brain and nerves, and the dispensing structures are the muscles, moving bony levers. Mechanically considered, the body is composed essentially of three kinds of tissues, supporting or bony; connecting or fibrous; and motor or muscular.

The balance, or posture, of the body at any moment is the result of the counterbalancing forces of its mass (or weight) against strain on connective tissues and effort (or work) of muscular tissue. By strain is meant tension due to the separation of parts. By effort is meant the contraction of voluntary muscles.

Strain and effort, and therefore energy, may be economized by so placing the body or its segments that the weight to be balanced by the connecting and muscular tissues is as little as possible. For this reason, the recumbent position is assumed for the purpose of rest. Dr. Goldthwait showed that even the recumbent position, unless carefully arranged, contains the possibility of strains against which the affected connecting tissues should be guarded.

In other positions and in movements, energy will be conserved by arranging the segments of the body as close to the gravity line as possible, or by balancing them nicely around the center of gravity. In standing, I think we agree that in the long run the most economical position is that in which the segments of the body are so placed that their long axes are as nearly parallel to the gravity line and as close to it as possible. The maintenance of this position requires some effort but minimizes strain. Since the effort required is sometimes estimated more by the concentration needed to keep unaccustomed muscles contracted than by the actual muscular work needed, it is often asserted by those whose habit of balance is preferably through strain, that the position of balance through strain is "easier" than the position of balance through effort. When weakened muscles are developed through exercise to do their part in holding segments in proper alignment, the ease and comfort of the mechanically favorable position becomes preferable to the strain of the mechanically poor position.

In those positions in which balance is maintained by the displacement of segments laterally or anteroposteriorly away from the gravity line until stopped by the tension of connecting tissues, the force exerted by the weight to be supported is increased, owing to its displacement. Some joints will be held at one extreme of their range of motion, and the strain on connecting tissues in time causes them to yield and become elongated. Finally, changes in shape may be expected in the bones themselves. Changes in the position of viscera and consequent functional difficulties may also be expected.

Mechanically, then, the best or most economical position of the body in standing will be that in which its parts are approximated most closely to a vertical passing through the center of gravity.

The weight of the engines and casings of the body, when not in the line of support, are placed in front of it; hence, effort or strain occurs mainly at the back, or dorsal aspect, of the body.

We may locate the main points of effort or strain in the standing position by considering each supporting segment in order, from below upward.

The foot is a buttress placed against the leg to brace it against falling forward, to distribute the descending weight over a wider area, and to facilitate motion. To be an effective buttress, it should be held in the direction in which the body tends to fall (or move), and the weight so received that it will be "shed" forward-outward directly through the bones of the foot to the ground. The point at which pressure from above seems to produce the greatest stability in the foot I have found to be on the line between the middle and outer cuneiform bones.

I like to consider the feet as lateral halves of a dome-shaped structure intended to shed weight as a roof sheds rain. If the dome is kept high, weight is successfully distributed to the ground through the normal points of support, leaving the arch intact. If, for any reason, the dome is lowered, weight is not shed so successfully, but causes strain and further lowering of the arches of the dome.

The foot, then, tends to be flattened downward. The sustaining muscles are chiefly the anterior tibial, the long peroneus, and the toe flexors. In strain, the plantar ligaments are affected, and probably also the ligaments connecting the talus and calcaneus and the mesial ligament of the ankle joint.

The leg tends to fall forward. It is held upright by effort of the tripceps surae (gastrocnemius and soleus). In strain, the connective tissues of the same muscles are involved until bony locking of the ankle joint is reached.

The thigh tends to fall backward. It is held up in position by effort of the quadriceps femoris. In the position of strain or "back knee," the tendons and ligaments posterior to the knee joint keep the femur and leg in line.

The pelvis tends generally to tip forward, that is, to become more sharply inclined toward the ground. In the position of strain the pelvis may be balanced either by a passive tension on the hamstring tendons in increased inclination, or by the iliofemoral ligament if its inclination is markedly decreased.

The spine tends to collapse forward and downward. It is held in the position of extension by the posterior or extensor muscles.

In the position of strain due to pronounced flexion, tension occurs on the ligaments and soft parts at the back. If balance is obtained by exaggeration of both dorsal and lumbar physiological curves, strain is present on the ligaments and other tissues passing over the convexities of both curves.

The head tends to fall forward. If the plane of the eyes is to be kept horizontal, the neck will also buckle forward. The neck is held straight through effort of the longus colli and posterior muscles and the head by muscles both in front and behind. In the position of strain, the anterior ligaments of the cervical spine may be under tension.

The rib cage tends to collapse downward. It is held in a position in which the ribs are freely movable by the erector muscles of the spine. Strain, in the absence of muscular control, is felt at the back.

The abdomen tends to sag downward and forward. In the position of effort it is supported mainly by the

lower third of the rectus muscles. In the position of strain the connective tissue of the anterior abdominal wall is under tension.

The "shoulders" and scapulae tend to slide forward and downward. The scapulae may be held in the position of effort by the lower trapezius mainly. In the position of strain the interscapular connective tissues are under tension.

Posture that can be called "good" must be good for something. We are familiar with hygienic, economic, social and esthetic values attached to a "good" posture. From the foregoing analysis I submit that the intrinsic value of a good posture lies in its mechanical efficiency, that is, in the conditions it creates for the economical manufacture and use of energy. The extrinsic value of good body mechanics is esthetic. In my opinion, really good body mechanics is the foundation upon which true beauty of position and movement may be developed. That the rank and file of the population in our country is far removed from this conception is evident to any trained observer. Ideals differ profoundly in this, as in other matters.

In standing, good posture mechanically means that relation between parts most favorable for the manufacture and use of energy. It is also that position which requires the least consumption of energy in its maintenance.

Good standing posture aesthetically is that which, while maintaining mechanically advantageous relations between parts, exhibits an ease or plasticity as the result of a more intelligent control of muscles in relation to each other.

In sitting, good body mechanics requires that the feet shall rest fully on the ground in a parallel position. In the knee and hip joints there is flexion to a right angle or slightly less. The spine is held erect with diminished lumbar and extended thoracic curves; the head is facing forward with the plane of the eyes parallel to the ground. The scapulae are depressed and the forearms may rest across the thighs (hand on the lap).

In motion, good body mechanics require the best obtainable mechanical conditions for the manufacture of energy as well as the most economical expenditure of energy to produce the desired effect. When these conditions are met, a movement will probably be called skillful. If, in addition to the mechanical conditions of economy, a movement exhibits also an ease or plasticity as the result of a more delicately adjusted coordination of muscular interplay, the movement will be found to possess "form," or grace, or beauty.

It is helpful to keep this distinction in mind as we notice others at rest or in motion, swiftly analyzing positions and movements in order to estimate the degree of mechanical efficiency or seeking the sources of beauty. In dancing we find less pleasure in extravagance of emphasis than in the exquisite control of a Pavlowa or a St. Denis. In swimming, the frantic splashing of the crawl seems wasteful compared with the smoothness and relaxation of strokes executed for "form." In teaching or in watching athletics, we are patient with the awkwardness of the novice and with the hardness of conscious skill, but take delight in the relaxed ease of poise and motion of the finest players.

The arts of drawing and sculpture offer a fertile field for the study of balance. The masters show keen insight into the problems of poise, and give true delineations of working muscles. Many models, nowadays, seem to rely on strain rather than on effort in their posing, as may be seen in any representative collection of modern sculpture.

III. Applications to Physical Therapy

The physical therapist has one great advantage over the teacher, in that many of her patients have presumably already experienced physical consequences due wholly or in part to poor body mechanics. They have insistent personal reasons for seeking improvement, if this be only to lessen or prevent discomfort. The teacher often has to supply all motives to pupils unawakened to the present disadvantages or future discomforts involved in their posture. With normal joint mobility and uninjured nerves and muscles, the problem is comparatively simple. Cases that tax ingenuity and resourcefulness are correspondingly interesting and rewarding.

Good body mechanics requires in the first place a proper alignment of segments, and in the second place sufficient muscular strength and control to bring about and retain the best possible mechanical relation between parts. There are three methods that should prove useful in every case: information, exercise and habit.

I find that exercises are done with greater intelligence and care, unfavorable habits relinquished less reluctantly and favorable ones adopted with more conviction if information concerning reasons and effects is freely available. Indirect means are often useful, as what a person finds out for himself has greater value for him than something he is told by a person who has reasons for wanting him to believe, or to do, a certain thing. Acquaintance with the skeleton, mounted and disarticulated, muscle charts, suitable texts on anatomy and physical education, timely articles, pictures and cuttings from magazines and papers—whatever will serve to illustrate a condition or suggest an improvement will make an impression sooner or later.

Exercises are needed for two purposes: to improve strength and to develop control. Exercises must be so devised that motion will be limited to the selected joints and accomplished by the preferred muscles. They should be performed slowly and with concentration, but not beyond the onset of fatigue.

Habits favorable to good mechanical relations between parts are necessary if permanent improvement is to be secured. The individual must be studied, and should be encouraged to study himself, in order that habits or practices that are detrimental may be detected. He should be encouraged and assisted to establish others more suited to his needs.

Muscular Controls Helpful in Maintaining Good Mechanical Relations Between the Segments of the Body

1. The feet. The single most helpful muscular control for maintaining the integrity of the feet is that which insures proper weight incidence. The attempt to improve weak and pronated feet merely by working with the muscles supposed to be responsible for sustaining the arches was a discouraging and unwelcome task until Dr. Lowman showed us the part played by relaxed and stretched rotator muscles of the femur in permitting postural knock knee and pronated ankles. Now, in many cases, I find what is chiefly needed is control of the outward rotators of the femur (lower gluteus maximus and the small deeper muscles attached without and within the pelvis). Standing with feet parallel and fixed, strong contraction of the lower part of gluteus maximus—which can be felt and seen—obviously improves the position of the foot and brings into view a longitudinal arch which the individual was sure she did not have. As an exercise this is simple and effective. The habit of standing with the gluteus contracted is not hard to acquire and is also needed for other reasons.

2. The leg. Aside from postural knock knee, which is also taken care of by use of the outward rotator muscles of the femur, a frequent mechanical fault is

the locking of the joint in complete extension, with the body weight in front of the center of the joint. The leg is held straight by tension on the posterior ligaments and tendons. Strain is inevitable, and the possibility of injury is present through inability suddenly to yield. Here it is necessary to substitute muscular control for strain, and the normal quadriceps may soon be induced to accept the task. To break this habit, however, requires no little attention on the part of the pupil. Since an ugly bulging curve of the calf is often the result of this posture, the aesthetic appeal may be effective. Parallel knee bending to half-way or less is a good exercise.

3. The pelvis. The position of the pelvis may be compared to that of an individual standing over the fulcrum of a seesaw, who attempts to regulate its motion notwithstanding an inequality of the weights at either end. The pelvis influences and is influenced by the position of the segments below and above it. It seems to prefer to tip downward in front. The muscle that controls it most effectively is the gluteus maximus. Exercises for developing this control I call "pelvic rocking" exercises. The pelvis is moved in both hip joints, contraction of the gluteus producing extension in these joints, or decreased inclination, and relaxation permitting the opposite movement. The use of other muscles, even of the rectus abdominis, is discouraged. The pelvis can economically be controlled by the use of one pair of muscles, the great gluteals, and no others seem to be needed. It is helpful, too, to be able to concentrate on but one thing. Pelvic rocking may be done in lying on the back with the knees bent, in lean standing and in standing. On asking a small class what this motion and control accomplished, the reply came at once: "Why, it solves all your problems." So it did, for her.

4. The lumbar spine. If the lumbar spine has been allowed to bulge backward, as happens in individuals with long, weak, round backs, strengthening and stronger habitual effort of the erector spinae muscles is indicated. Exercises in prone lying, prone kneeling and prone sitting are useful.

Where the lumber spine arches forward, as in hollow back or from backward displacement of the thoracic spine, the lumber flexor, quadratus lumborum, must be developed and used. I have never been cordial toward the advocated use of the anterior abdominal muscles as props to the lumber spine. They have their own work to do, and are needed for it, just as the muscles moving the feet are needed for that purpose and should not be asked to take on the burden of faulty weight incidence. Control of an inward sagging lumbar spine by contraction of the quadratus lumborum is simple, direct and effective. These muscles are not needed for other purposes than to move or steady this part of the spine. Exercise for the quadratus I call "lumbar flexion," or "humping." They are done in the four-footed position, in sitting and in standing, with a partner or a girth to offer the resistance needed to localize the muscular action and to call forth the desired strength.

5. The thoracic spine. This part of the spine has normally but one serious problem: to maintain itself against the forward-downward drag of the thorax and arms. The extensor muscles can be strengthened and made sensitive to their duty by exercises in which the lumbar muscles are not allowed to perform the major part. Exercise in prone lying, prone kneeling and prone sitting, limited to extension of the thoracic spine, will be effective in strengthening the thoracic erector spinae. To maintain an erect position of this part of the spine it is necessary that all segments below be properly placed, especially the pelvis and lumber region. Easy extension, not rigidity, is the object, and a sensitiveness to position that will register insidious side bends and twists as well. Habitual positions must be carefully studied and made favorable to the maintenance of extension in this region.

6. The neck and head. The usual position of forward head is the result of flexion in the upper thoracic spine, hyperextension (or forward bulging) of the cervical spine, and an upward tilt of the face. Improvement follows upon the opposite motions: downward tilting of the face, straightening of the neck by means of the longus colli, and extension of the upper thoracic spine. Lying on the back and raising the head with the chin toward the chest is apt to disclose unexpected weakness of the anterior neck muscles. With the head and neck under control, the upper thoracic spine may be straightened against resistance on the back of the head. This exercise is best done in sitting, with the hands grasping a stall bar at shoulder height. Pushing the back of the head up, with the chin low, is also an effective exercise.

7. The chest. With the thoracic spine held easily extended, the chest should be well placed. The ribs should be free to move either up or down, and the subcostal angle should be moderately wide. I have no enthusiasm for a distended thorax.

8. The abdomen. Good mechanical position of the abdomen depends on two factors: a favorable position of the pelvis and sufficiently short abdominal muscles. A very moderate inclination of the pelvis with its attendant straightening of the lumbar spine draws the contents of the abdomen backward, relieving the abdominal wall of part of their weight. An evercise to strengthen the abdominal muscles, which may be done in lying with the knees bent, or in lean standing, consists in shrinking the abdominal wall with an upward contraction to the limit of shortening. This exercise may produce soreness in persons with very weak muscles, but I doubt if it could prove injurious, especially if done in lying with bent knees. The habit of standing and moving with the hips low and an upward pull with the abdominal muscles should be encouraged. Where the muscles are relaxed, a strip of firm elastic webbing two or three inches wide passed around the body crossing the sacroiliac joints, below the iliac crest and just above the pubic bones, gives welcome support and often secures relief from low backache. The object of exercise is to replace the upward pressure of the webbing with firmly developed rectus muscles.

The only successful suggestion that I know for giving an idea of the muscular action needed is to "push or pull *up* with the *lower* part of the abdominal wall." Commands to "pull in with the abdomen" or to "flatten the waist" result in contraction of the transversalis which narrows the middle and upper part of the abdominal cavity and is apt to produce bulging of the lower part of the abdominal wall. Conscientious efforts to follow such instructions produce neglected lower muscles and a transversalis so tense that the process of re-education is difficult and tedious. If more work were done with the muscles open to inspection, the unfortunate tendencies of such instructions might be observed.

Since the position of the pelvis and lumbar region is so important for good mechanical relations of the parts above and within the abdomen, it seems strange that the mechanism for securing favorable conditions here should have been so misunderstood. These three parts have each one pair of muscles best adapted to hold it against the influence of gravity: gluteus maximus for the pelvis, quadratus lumborum for the lumbar spine, and the lower third of the recti for the anterior abdominal wall. No one of these should be expected to do work properly belonging to either of the others. All together and without

undue effort, they should be able to maintain mechanically favorable relations between these parts in position and in motion.

9. The scapulae. Though malposition of the scapula may be a conspicuous postural fault, it will be the last to receive attention in improving body mechanics. If resistant to adduction, stretching may be undertaken while other work is going on, but no attempt will be made to secure an improved position of the scapula through its own muscles until other segments of the body, and especially the spine, are well under control. With the spine firmly placed, the subject will be taught to depress the scapula with the lower part of the trapezius and finally to adduct it without using the central portion of this muscle. If arm movements are used, those in extension (i. e., in the transverse plane of the body) are best, and movements of adduction and outward rotation to be preferred. Since the scapula is the offending element, sufficient strength and control of the proper muscles of the scapula must be developed. Here also much careless work has been done. With the back exposed it is easy to see why exercises of strength leave the position of the scapula comparatively unimproved. The posterior muscles are not large, they have powerful opponents, including nearly always the weight of the arm. Exercises must be carefully devised and used with discretion. Selection and control are more important than strength, at first. An erect position of the thoracic spine and only a gentle curve of the posterior wall of the thorax are necessary if the scapulae are to be kept flat on the back with the vertebral borders parallel to the spine and fairly close to it.

It seems that we have undertaken a large task in the attempting to improve the body mechanics of a heedless generation. We have, indeed, and the task is likely to grow larger rather than less. The present emphasis in physical education on play activities and on little else, from the kindergarten on through college, means that the parents of the children who will soon be among us will know little and perhaps care less for good body mechanics.

From recent indications, however, it seems not unlikely that a demand will be heard for instruction in body mechanics in the schools. This need has been discovered before, in similar circumstances. How important that teachers be adequately prepared to give sound instructions in a matter so important to physical welfare! It is a prospect that should encourage us to deeper study and more careful practice, that we may not only help the sick but preserve in the well their health and beauty.

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Abstracts

John S. Coulter, M. D.

Status and Technique of Natural and Artificial Heliotherapy. By Percival Nicholson, M. D., in Weekly Roster xxiv:46:15-26: July 20, 1929.

Considerable discussion has arisen as to the relative merits of the natural and artificial forms of ultraviolet light. From a practical point of view one can consider that in the temperate zone such as we live in, in Philadelphia, during the summer months, May, June, July and August, natural heliotherapy can be used most of the time. It is necessary to observe careful technique in the administration of natural sunlight as to dosage, by some such method as that advocated by Rollier. Patients are graduated to increasing periods of exposure over increasingly large areas of the body. It is necessary to avoid any severe sunburn, a slight reddening of the skin followed by tanning being all that is desired.

Undoubtedly the increased metabolism observed in Rollier's cases came from the air baths given at the time of the heliotherapy.

Natural sunbaths may be continued well into the winter, but one must remember that in the temperate zone, during the winter months, it is mainly the effect of the air bath the child gets.

In reviewing the above facts we find that should ultraviolet light transmission glass give 100 per cent transmission of ultraviolet rays, as quartz does, the practical value of such glass would be very slight, for two reasons: (1) Dr. Alfred Hess, using a pure quartz window, found there was not enough ultraviolet light in the sun's rays in the winter months to act as a protection for or curative of rickets. (2) Mayer has shown that fresh circulating air is a very important part of ultraviolet light treatment, to increase metabolism.

The main sources of artificial ultraviolet are the carbon arc lamp and the mercury vapor quartz lamp.

From 15 to 30 times longer exposures are required when the carbon arc lamp is used. Such excessive heat is emitted from the carbon arc lamp that the child has to be kept at a comfortable distance, reducing the efficiency of the already small amount of ultraviolet rays, in inverse ratio to the square of the distance away from the child's skin.

Block and Faber in Copenhagen state: "Our first experiments with the carbon arc light in the treatment of tetany were as mentioned carried out in 1914. We soon had to abandon them, however; the strong light and heat acted too drastically on the children, who reacted with perilous attacks of laryngeal spasm and eclampsia. In our present experiments we have employed the much less luminous mercury vapor quartz light which gives less heat."

The mercury quartz vapor lamp, on the other hand, can be considered to emit nearly 100 per cent ultraviolet rays. About 17 per cent are of shorter wave lengths than those found in the lower limit of the sunlight.

As the result of the above facts, in the hands of medical men, the mercury vapor quartz ultraviolet lamp is almost universally used, when an artificial means of obtaining ultraviolet rays is desired.

For the last two years the method of Eidnow and Hill has been used (by the author). It can now be said that more uniform and better results have been obtained by this method than by any other. The burner is placed at from 36 to 30 inches from the skin surface and treatment begun with one to two minutes' exposure to the front of the chest. In two days the patient returns, when a report is obtained as to the presence or degree of erythema developed after the last treatment. The burner is maintained at the same distance and the dosage time estimated to give a mild erythema, using the back at this visit. At the third visit double the exposure time required to produce a mild erythema on the back is given to the front of the legs. Patient returns for the fourth treatment two days later, the back of the legs being rayed, giving the same time as is necessary to produce a mild erythema on the front of the legs. At the fifth visit a return is made to the first area rayed and sufficient exposure to produce a mild erythema is given. By this method the danger of over treating is obviated and the skin is being kept light sensitive. Tanning is purposely avoided and the treatment time increased very slightly, enough to maintain a mild erythema at each visit. The distance from the burner to the patient's skin is kept the same throughout. Dosage is varied according to the skin reaction of each patient. Uniform dosage is obtained as the voltage is kept at a constant level. This method is used when a general tonic treatment is desirable.

If in the hands of such an expert as Rollier using natural heliotherapy bad symptoms could develop, it is clear that in the hands of the untrained layman much more serious results could be caused, especially if the more powerful ultraviolet mercury vapor quartz lamp is used.

The conditions in which ultraviolet light is of proven value: Rickets and the often associated diseases of tetany and spasmophilia.

In tuberculosis, ultraviolet light has had a very marked and almost specific action, especially in bone, gland and joint cases, in conjunction with good orthopedic care.

Probably next most commonly benefited by ultraviolet ray therapy are cases of eczema. Here intensive local applications are necessary in combination with general treatments.

The air cooled mercury vapor quartz lamp is often of great value in furunculosis, ringworm, impetigo and various bacterial skin infections. In certain types of asthma it is of decided value.

When there is a preexisting anemia, correct doses of ultraviolet irradiation increase the hemoglobin and increase the bacterial powers of the blood serum, but overdoses tend to produce anemia and lower the bacterial power of the blood.

In any type of suppurating wound, ultraviolet rays are often very useful in hastening recovery, but have to be used with extreme caution as to dosage and should not be used in the presence of acute infection of a general nature except, possibly, peritoneal tuberculosis.

The Clinical Value of Sunlight Through Ultraviolet Transmitting Glass. By George W. Caldwell, M. D., and Roger H. Dennett, M.D., D.Sc. New York in Journal of the A.M.A., 92:25:2088-2090: June 22, 1929.

In their conclusions these authors say that:

Infants and children may be given sun baths of two or three hours daily thoughout the winter, not as a substitute for ultraviolet lamp irradiation in the cure of disease but as a prophylactic measure.

There are ample ultraviolet rays in the antirachitic range in this latitude during the winter to be of definite value to those receiving them through this type of window glass when exposures are made in the direct path of the sun's rays, since enough of these rays penetrate the glass to prevent rickets and spasmophilia in a normal properly fed infant.

It is unfortunate that so much has been said about solarization that the general impression has been gained that after the glass is aged there is no therapeutic effect. This is untrue, as is shown in the report.

Ultraviolet Rays in Treatment of Intestinal Tuberculosis. By F. B. DeWitt in U. S. Veterans' Bureau M. Bull., 5:517:July, 1929; abstract in Journal of the A.M.A., 93:4:334:July 27, 1929.

DeWitt has seen marked improvement from the treatment of intestinal tuberculosis when only ultraviolet rays from the mercury vapor lamp were used. Special cases are not selected for treatment. The majority of his patients are in the far-advanced state of the disease. He uses the quartz mercury vapor lamp, beginning with daily exposures of one and one half minutes at a distance of from 30 to 40 inches. After one week, if there is no increase in the temperature or pulse rate, the exposure is increased one and two minutes each day, the lamp gradually being lowered to about 20 inches, with the maximum exposure fifteen minutes front and back.

Tuberculosis in Infancy and Childhood. By Harry C. Metzger, M.D., in Journal of the Michigan State Medical Society, 28:6:446:June, 1929.

The therapy in tuberculosis consists of dietary measures, improvement of the hygienic surroundings, and heliotherapy. Modern observers have noted that a high fat and high protein diet, with one relatively low in carbohydrates, is beneficial. Heliotherapy is indicated in all forms of tuberculosis except the pulmonary type.

Actinotherapy in Diseases of the Eye. By W. S. Duke-Elder, M.A., D.Sc., Ph.D., M.D., Ch.B., F.R.C.S., in British Journal of Actinotherapy, 4:4:82-84:July, 1929.

The author says in his summary:

The value of actinotherapy in ophthalmology may be summarized as follows: Treatment by general irradiation is of value in any chronic infective disease of the eye, and its effect is especially marked in a debilitated patient; but its value in tuberculous and phlyctenular conditions is inestimable. Local irradiation of the eye itself should be limited to the treatment of diseases of the anterior segment, and in this case a technique should be employed which ensures an adequate control of the beam of light, and a complete avoidance of the lens. For this reason it can only be suitably employed by an operator who is acquainted, not only with the uses and abuses of ultraviolet light generally, but who is also an expert in the manipulation of optical apparatus as applied to the eye. Used as such the effect of lights is often dramatic in the treatment of corneal ulcers of all kinds, ranging in severity from a hypopyon ulcer to the small recurrent and marginal ulcers which are frequently so troublesome when the routine methods of treatment are employed. The method is also indicated in conditions of sclero-keratitis and, in much more heroic doses, in many chronic infections of the conjunctiva ranging in severity from an infective blepharo-conjunctivitis to trachoma. In all of these diseases where the etiology is tuberculous, so much more are the results satisfactory.

Infantile Eczema. By C. O. King, M.A., Birmingham, Ala., in Southern N. J., 22:6:566:June, 1929.

Some, very few, selected cases respond well to ultraviolet light. Radiation should be mild, just sufficient to produce a mild stimulating actinic effect, never approaching an erythema dose. Two or three treatments a week, beginning with 15 inches for 4 minutes and gradually increasing the time, are advisable. I recall three cases recently in which happy results were obtained by this means.

X-ray, admittedly our most powerful weapon, should be used only in the cases where other measures fail for its anti-pruritic effect. Its absorptive and anti-pruritic effect is also demonstrated in chronic infiltrated patches. I see no reason why the ordinary local applications cannot be used at the same time. One quarter of a unit, repeated one time in a week, or one eighth repeated twice, acts well. One's apparatus should be accurate and utmost caution and care should be used in graduating X-ray dosage. One should have a complete understanding of the dermatologic aspect of the case and the capacity to observe and interpret correctly the slightest morphologic changes in skin lesions.

Ultraviolet Therapy in Pediatrics. By R. H. Kuhns in Archives of Physical Therapy, 10:154: April, 1929; abstract in Journal of the A.M.A., 92:25:2137:June 22, 1929.

At the Children's Memorial Hospital in Chicago the quartz lamp has been used for some time and the results have been quite satisfactory. In addition to being used in rickets and other deficiency diseases of infancy and childhood, it is employed in tuberculous sinuses and glands. Kuhns asserts that great precautions are taken in the use of the light. No child is treated if the temperature is 100.6° F. or over, or if the skin shows a rash or desquamation. The eyes are bandaged during the treatment. Children with tuberculosis are always treated one at a time and after the irradiations to the other children are finished.

Notes on the Use of Wood's Glass. By N. Gray Hill, Carshalton, Surrey, England, in Med. Jour. and record, CXXIX:12:664-666:June 19, 1929.

Of the various uses to which the practitioner may turn his action lamps, I think there are few that are more valuable than that of the diagnosis of ringworm.

The diagnosis of ringworm is easy when there is a definite rounded patch of scalp covered with minute brany scales, but when only one or two hairs are infected the diagnosis may be very difficult; it may be almost impossible without the aid of Wood's glass. As described by Dr. Pugh in his paper on the work at this hospital, all children when first admitted before they are allowed to proceed to the wards are examined by the sister in charge of the light department. If ringworm is present, they are forthwith transferred to the board's special hospital for treatment and this hospital is kept free from infection.

If there is a single hair affected by microsporon audouini, the common type of ringworm met with among children in England, it will become a brilliant metallic green when viewed under the ringworm lamp and if there is the typical small ringworm patch the hairs will fluoresce in such a striking way as to be easily recognized by the most casual observer. If the hairs are infected by trichophyton megalosporon, a type of ring-

worm that is found in less than ten per cent of the ringworm patients, the appearance of the hairs is less striking but still quite obvious. The infected hairs become a luminous phosphorescent white and though far less lovely than those infected with the common ringworm, they are still markedly different from the normal hairs.

It is chiefly to the French investigators, Margarot, Deveze, Meyer, Vigue and others, that we owe the first papers dealing with Wood's glass, or the filtered light that they speak of a Wood's light, from the dermatologist's point of view.

It is stated by several observers that certain rashes, more especially the rash of secondary syphilis, can be observed and recognized when searched for under Wood's light several days before it becomes visible in ordinary light and that it can also be seen on the filtered light after it has faded and become invisible in ordinary light.

The type of lamp that is used in this hospital is a water cooled Kromayer mercury vapor lamp with a small piece of Chance's ultraviolet glass placed in an applicator.

CONCLUSIONS

By the use of Wood's glass ringworm can be diagnosed with ease, safety and certainty even when the disease is in the earliest stage.

In the examination of a patient with disease of the skin Wood's light should be employed and with experience it should prove a valuable aid to diagnosis.

Orthopedics—Indications for Natural Heliotherapy. By A. Gottlieb, Los Angeles, in Cal. and West. Med., xxx:6:430:June, 1929.

The physiological effects and the modes of application of sun-air therapy have been frequently described in medical and lay literature. The indications of heliotherapy may briefly be outlined as follows:

The indications for solar radiation cannot be laid down by enumerating individual diseases. Heliotherapy should find application where, from theoretical consideration and from practical experience, it can be regarded and has proven to be beneficial and effective. The claim of the healing power of solar radiation in so-called surgical tuberculosis is at present admitted by the highest medical authorities. The controversy between those who advocate operative interference and the group who favor conservative sun-air treatment in surgical tuberculous lesions still goes on. The adherents to the radical procedures, however, admit that heliotherapy is beneficial during the period of post-operative convalescence or as a preparatory measure to raise the body resistance to build up the patient's general condition. Surgery in an individual, especially in young persons in poor general condition with the disease in an active stage, is but infrequently performed even by the most radical advocates of the scalpel. To increase resistance, strengthen musculature and tonicity, nothing equals systematic heliotherapy. Preoperative solar therapy may prove beneficial beyond expectation so that a contemplated operation may no longer be necessary. The contention of men like Freiberg, Meyer, and a score of other writers, that surgery and heliotherapy have each their special indications, must be accepted as true. Each procedure must be administered, not to exclude but to supplement the other.

Sun radiation has been proven of inestimable value in calcium deficiencies, such as rickets, osteomalacia and delayed union of fractures, the healing of which is enhanced by the rise of the constitutional resistance; also in localized conditions, such as wounds of various types, severe traumatization of soft tissues, ulcerations due to circulatory or neurotrophic disturbance and infected wounds. Greatly benefited are many pathological manifestations which are the outcome of systemic infection. Here may be mentioned chronic osteomyelitis, chronic arthritis, and lesions of syphilis refractory to specific treatment. In orthopedic practice, heliotherapy finds indication in the deficiency diseases of the type of Osgood-Schlatter, Legg-Perthe, Freiberg, Koehler, and other conditions classed as osteochondritis, as well as in tuberculous bone and joint affections and in chronic arthritis. Also in myasthenia, muscle atrophy, and paralysis, has the muscle-building effect of the sunray been of real value.

The sun-air therapy must not be regarded as a specific but rather as an activating agent, as a generalized therapy. Its administration must be based upon the assumption that the local lesion is but a manifestation of a constitutional disease or deficiency. On the basis of this assumption, heliotherapy may well be adopted as an adjunct to other recognized methods of treatment.

Ultraviolet Rays. By C. G. Lane and E. M. Rockwood, Boston, in Arch. Derm. & Syph., 19:459: (March) 1929; abstract in Journal of the A.M.A., 92:16:1385: April 20, 1929.

Further evidence is presented by Lane and Rockwood of the great variation in the reaction of the skin to the ultraviolet rays and of the fact that the term "erythema dose" means little. The lithopone test satisfactorily measures the comparative efficiency of various ultraviolet lamps, and checks the efficiency of a given lamp from time to time: (1) It furnishes a transferable unit of measurement, and (2) it suggests the need of having a lamp "build up" for about twenty minutes and of bearing in mind the size of the opening used. The difficulties of matching colors are a handicap, and the value of the test will depend on the wide distribution of a satisfactory stable product.

The Treatment of Heart Disease. By Arthur E. Mark, M.D., Los Angeles, Calif., in Medical Searchlight, 5:14:19-21: July 15, 1929.

EXERCISE

The question of exercise is an individual problem governed by conditions present. It is a common occurrence for a patient to carry a mitral regurgitation through life and frequently attain a ripe old age—this often in spite of no restriction of activities. It is, however, impossible to prognosticate regarding the myocardium in these patients and it is safer to treat all cardiopaths from the standpoint of avoidance of undue physical stress. Such strenuous pursuits as mountain climbing, as advocated by some European authorities, are hardly consistent with safety. The same applies to such exercises as tennis, football, basketball, squash, etc., which are much too severe.

Walking, especially on level ground, and in amounts to meet the individual requirements, is ideal. Golf, if properly controlled and on a course not too hilly, is permissible in many cases. Limitation of playing to nine holes, in my opinion, should be applied to even the mildest cardiacs. The development of dyspnea, palpitation, cardiac pain, etc., should always be avoided. Many cardiacs should have restriction to a point where no more than one or two blocks of daily walking is carried out. In general, we should be governed by the type of lesion and the tendency to develop cardiac symptoms, stopping short of the latter being the ideal to be sought.

MASSAGE

Massage is especially valuable in bed-ridden patients.

It gives a sense of well-being to the patient and has a definite sedative effect.

HYDROTHERAPY

This is frequently overdone, and for that reason, is often productive of harm, especially in patients with severe heart diseases. Beneficial effects, especially when treatments are carried out at springs, are, no doubt, due more to the change of environment, rest, etc.

DIATHERMY, ULTRAVIOLET AND ROENTGEN RAYS

The medical profession has become over-enthused with the use of diathermy and ultraviolet ray treatments. I have observed frequent instances where heart disease is being treated with these agents. Chest pains may and frequently do show response to this treatment, but response of intrinsic cardiac pathology and permanent lowering of blood pressure could hardly be expected from their use.

X-ray treatments have been used in cases of rheumatic carditis and angina pectoris.

Levy and Golden give an interesting review of the work already done, as well as a report of their own cases. In general, their conclusions would indicate that while results are indefinite, favorable results are possible, especially in early cases in the first attack of rheumatic fever.

Supervised Exercise as an Aid to the Mentally Ill. By John Eisele Davis, M.A., Senior Physical Director, U. S. Veteran's Hospital, Perry Point, Md., in The Modern Hospital, xxxii:6:81: June, 1929.

Physical exercise as a valuable aid in the treatment of the mentally ill is being generally accepted, as the result of years of trial and experimentation. It has been fully established that 85 per cent of all psychotics and psychoneurotics of the average age of the veterans of the late war will participate in a comprehensive physical program carefully administered by capable therapists. Any medium that will promote the physical activity of this percentage of the mentally ill is entitled to the serious consideration of those responsible for the administration of the state and federal hospital system.

The precox group, which represents the largest percentage in the average hospital, the manic depressives and general paralysis cases, whose deterioration is not so pronounced, many traumatic and epileptic cases, will respond readily to a diversified program, administered with careful attention to changing personalities and physical conditions.

Posturing and Varicose Veins. By Douglas H. Stewart, New York, in Medical Jour. & Rec., cxxix:11: 609-610: June 5, 1929.

This author says the "great efficacy" of posturing lies in its employment as a helper or synergist.

Vicious circle No. 1 is the well known Trendelenburg, within which the blood passes from the tibial and peroneal veins into the popiteal and femoral veins. Some blood leaves the femoral, again enters the saphenous and flows toward the periphery. Breaking up or mitigating the evil consequences of this and of similar vicious circles constitutes the whole worthwhile endeavor in the treatment of varicose veins.

Let that person (with the varicose vein) go to bed, hoist his feet up in the air, the higher the better; let him keep them there for five minutes and let him lower them slowly to the recumbent position. The veins are empty and the vein walls rest.

This simple maneuver returns stagnant venous blood to the general circulation, stops the dilating strain and puts everything in a more favorable position for a return to the normal.

Vicious circle No. 2 is called Macy's vicious circle for lack of a better name. Its dilated channels are irregular and nameless. Its area is more or less limited to the calf of the leg.

The worst position of all turned out to be a standing firmly on the heel and toe, with both feet side by side, combined with a leaning of the whole body forward. Maintenance of this position was a direct strain upon the calf (postcrural muscles, superficial group). Yet this position was maintained hour after hour by saleswomen behind counters.

The idea is that the feet should never be side by side, but the heel of the left foot should be placed a trifle in advance of the toe of the right foot. Every hour or so the right should be advanced and the left drawn back. On the half hour there should be a return to position number one.

Whether high or low heels are worn, of importance is the turning of the toe of the advanced foot a little in and standing upon the outside of the foot. This will be found an excellent calisthenic practice. Moreover, it is a means of relieving foot strain and fatigue. All proper exercise is to be commended.

Anterior Poliomyelitis. A Study of the Acute Stage with special reference to the Early Diagnosis and Treatment. By Rex L. Diveley, A.B., M.D., Kansas City, Mo., in Journal of Bone and Joint Surgery, 10:11:1: January, 1929:104.

During the stage of recovery, it was definitely shown that complete rest of the affected parts in casts and splints, during the first four to six weeks, was by far the best form of treatment. But this period should not be prolonged. The period of complete rest should be gauged by the disappearance of the muscle soreness and rigidity. When these symptoms disappear, light massage and individual muscle training should be started. Electricity and the salt-water tub may be added. Many cases showed some benefit by heat from an incandescent light, suspended from a cradle over the affected part. Picard and others have reported good results by the use of diathermy. Bordier, Philips and Galland and others have noted striking recovery with the use of the roentgen ray during this stage. With these agents, the author has had little experience and feels that they should not be condemned until tried.

Ankle Fractures with Special Reference to Treatment and Return of Function. By Victor F. Marshall, M.D., and Clarence C. Reed, M.D., Appleton, in Wisconsin M. J., xxviii:7:300-309: July, 1929.

The essentials of treatment may be reduced to a formula:

1. Early reduction or correction of the deformity (setting the fracture).
2. Hold the fragments in position to grow together.
3. Massage and motion very early after reduction.

Massage and motions: Championnierre as early as 1877 treated fractures by massage and mobilization and taught that movements favor proper healing and callus formation. However, his teachings have received little attention. Early passive and active motion in the treatment of fractures have recently been advocated by Gibbon and others while Yates has emphasized the fact that fractures should be immobilized the minimum time for safety. Futhermore, Allison and Brooks have shown that bones atrophy from disuse, whatever the cause of the inactivity.

Massage improves the circulation and through the reflex action it stimulates the underlying tissues and hastens healing. Massage and motion reduce callus formation to a minimum and prevent discomfort in the limb, joint adhesions and ankylosis. They simulate nature's way in restoring useful function.

Much of the disability resulting from fractures is due to inactivity and prolonged immobilization with consequent slow healing, atrophy of muscles, stiffness of joints, etc. For in animals fractures nearly always heal with good functional results if left alone whereas when treated with splints and immobilization the results are usually poor. Therefore, the importance of massage and motion very early after the accident cannot be too strongly emphasized.

The technique of massage is not difficult but it must be gently and properly done so that the bone fragments are not disturbed. It consists simply in very gentle stroking motions with slight pressure, in the direction of venous flow and avoiding the site of injury. It should be started as soon as the acute reaction to the traumation has subsided, usually not later than the first week or ten days. The first seven to ten days following the accident are the most important for hyperaemia and early bone regeneration. Leriche and Pollicard found that ossification began during this same period, while green stick and fissured fractures may be completely healed in twenty days.

Massage should be performed for a few minutes, at least, every other day until healing is complete. The entire limb from toes to thigh should be massaged. Before the leg is massaged, the splint should be carefully removed. If a circular splint has been used it may be bivalved by cutting down the sides. The limb is well supported and great care should be taken not to disturb the bone fragments while massage is carried out. The splint is then replaced.

Passive motion of the knee and ankle should be started not later than the second week. This can be done immediately after the massage is completed, being careful not to cause pain or disturb the bone fragments. It consists in gently moving the ankle and knee once or twice in an anteropostero direction.

At about the end of the third week active movements by the patient are started very gentle and slight at first and gradually increased until the full range of motion of the ankle joint is regained. The final results are not entirely satisfactory unless full range of motion is obtained.

After Treatment

Besides massage, passive and active motion as above outlined, the after care consists in permitting the patient to be up and around on crutches after the first week. The splint is left off for one or two hours a day for a week and permanently at the end of the fifth or sixth week. In the average case, weight bearing is started in eight or nine weeks. In older people and in comminuted and compound fractures longer time, from four to twelve months, is required, because healing is slower. Weight bearing should be very gentle at first and the amount of weight increased slowly until full weight bearing and walking is done. A crutch or a cane should be used when walking is first started. Sir Robert Jones in his Orthopedic Surgery of Injuries says, "The presence of tenderness over the callus at the site of the fracture is a definite indication that the callus is still soft and will yield on the application of strain." There should be very little discomfort when walking is started and weight bearing should be postponed a week or two longer.

The inner side of the foot and heel of the shoe should be raised about one quarter of an inch, especially in eversion fractures. This gives comfort in walking and aids restoration of function. In some cases a steel brace as described by Cotton should be used. This prevents overstrain on the newly formed callus and consequent painful ankle, which sometimes results.

General measures, like fresh air and sunshine, good food, etc., should not be neglected. Electrical stimulation, diathermy and baking, are also of service. Schneider showed that an acid diet favored healing, but parathyroid hormone has not been of much value. Foci of infection should be removed and any defects in the general health should be corrected.

Conclusions

Fractures about the ankle are common, and serious injuries cause not only from three to nine or more months' loss of work but as much as 25 to 50 per cent permanent disability in some cases.

The disability can be reduced by:

(a) Immediate reduction and proper apposition and fixation of fragments.

(b) Massage of the entire extremity, beginning not later than ten days following the accident and carried out every other day until healing is complete.

(c) Passive motion of ankle and knee after the second week.

(d) Active movements of ankle and knee after the third week.

(e) Removal of the fixation apparatus at the earliest possible time consistent with safety, usually after the fourth or fifth week.

(f) Careful regulation of weight bearing until the callus is firm and discomfort has disappeared, and

(g) Judicious use of electrical stimulation, diathermy and mechanical supports.

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Contributed by Dr. H. M. F. Behneman

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